CIVIL DEFENSE FOR NATIONAL SURVIVAL

(PART 6—San Francisco, Calif., and Los Angeles, Calif.)

HEARINGS

BEFORE A

SUBCOMMITTEE OF THE COMMITTEE ON GOVERNMENT OPERATIONS HOUSE OF REPRESENTATIVES

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the program has failed, the blame should rest with apathetic public officials.

I consider the most important task of the Federal Government in civil defense is to bring to the American people the need of civil defense.

This cannot be done by the Federal Civil Defense Administration, nor can anyone do it iwth words alone; as long as there is no action by all agencies of the Federal Government to organize their own departments for civil defense, and until it insists that all their field agencies, that is, those outside of Washington, actively participate in local community civil-defense programs, the American public as a whole will not recognize the need.

I am happy to report that locally we have always had the cooperation of Federal agencies and that there are indications that all Federal agencies are becoming civil-defense conscious.

There is a crying need for more exact information. "The effect of atomic fission weapons" issued in September 1950, and a recent statement, February 5, 1955, by Mr. Lewis L. Strauss, Chairman of the United States Atomic Energy Commission, are the only official information that has been released on the effect of nuclear weapons.

There have been many articles and pamphlets based on extrapolation from the tables on the effect of atomic weapons, but no official statement as to their validity.

In many conversations with staff members of the Federal Civil Defense Administration, it is my opinion that they will also like to get decisions on many matters besides these, and most of all, they want the American people to have full information concerning the dangers they face.

All of these things affect many Government agencies, and there are undoubtedly sound reasons why the information has not been forthcoming. I am in no position to judge. I merely wish to point out that these things do adversely affect civil defense throughout the country.

Another product of the failure of the Federal Government to issue specific information has been the plethora of sometimes conflicting statements in the public press by persons endeavoring to read more into news releases than is actually there.

There has been a lack of definite information on which to base specific plans.

Civil defense is a very complex business, and there is grave danger of misunderstanding of what is meant because of oversimplification.

Now, sir, on the efficiency of liaison and cooperation, I have here a letter that we wrote on May 2 to Mr. Val Peterson. Among other things I asked the question on policy of evacuation, or take-cover, because when we started this information program, the Advertising Club was very insistent that we know what we are doing, because they said that if we teach these people one thing, it is going to be a terrific job to change that.

And we have got to know what we are doing in the beginning, to start with.

So we wrote this letter asking them for a firm statement on what should be done:

Mr. HOLIFIELD. Do you think that that plan should have the approval of the top military men in our Federal Government and the top civilian people charged with the responsibility for civilian protection?

Mayor POULSON. It is certainly one of the biggest responsibilities, one of the biggest jobs that we have facing us today. If these things we read right in the morning's paper today, about the testimony that has come out before this last hearing, are true, certainly that is the basis for our getting serious about it.

If all these statements that are made by both the Senators and the Members of the House on this subject—if just half of it is true—certainly it is time that we become greatly interested in the people and start to have some type of program, which we do not have now.

Mr. HOLIFIELD. In order to allay any doubt on the record as to whether the statements of the impact of this weapon are true or not, I would like to say, as an eye witness to the test in the South Pacific as well as to the smaller test in Nevada, and on the testimony of Atomic Energy Commissioner Libby before our committee and the testimony of our Chiefs of Staff and other responsible people, that the capacity for destruction of these new weapons is a capacity that is almost beyond belief.

The pictures that are presented down below the rostrum here of the cities of Hiroshima and Nagasaki are cities that were destroyed by 20,000-ton bombs, what we call 20,000 tons of TNT equivalent.

The bomb that was exploded, or the device that was exploded, in 1954 in the South Pacific, took out an island a mile long and almost a mile wide, and dug a hole in the coral 165 feet deep.

This was a ground shot. It was not a shot from the air.

Commissioner Libby testified that not only did it take 400 million tons of coral up into the air and convert it into a radioactive ash, but it also contaminated 7,000 square miles downwind with lethal radioactivity.

Now, we will have before us Dr. Stafford Warren and Dr. Bellamy of UCLA who will testify on this subject of radioactivity and how deadly it is, this fallout problem.

This problem, of course, has developed since, you might say, the fall of 1952 and the knowledge in mid-1953 that the Soviet Union has exploded a hydrogen weapon.

So we have had to take into consideration this tremendous fallout, which is very much greater than the atomic fallout, since that date.

So it is in comparatively recent times, you might say, 2½ years, that this factor has been one that has to be considered.

And, of course, this is the thing that makes obsolete a great deal of our military procedures in the past.

Mayor POULSON. That is right.

Mr. HOLIFIELD. You can no longer have mass landings on beaches as we had in World War II, for instance. You cannot have close convoy formations crossing the water with troops and supplies that we had during World War II.

There are so many of the factors of warfare that have changed in the last 2½ years that it is no wonder that we are lagging a little bit in our thinking on the local level, and we are just unable to adapt ourselves

Mr. STARK. Yes, sir.

Mr. LIPSCOMB. Mr. Chairman, could I ask a question there?

Mr. HOLIFIELD. Mr. Lipscomb.

Mr. STARK. Yes, sir.

Mr. LIPSCOMB. What is the reason that you emphasize this? Is it because you have had trouble, or do you feel that you have not received any adequate information?

Mr. STARK. Mr. Congressman, let me give you an illustration. There are a number of military installations in this area who would require, even though we were in bad shape in some degree, our support. Their own plans are classified, which is natural, and since they are classified they cannot divulge to us many of the things in many of the areas in which we would have to attempt to support them, at least.

This is a two-way street, actually. We are not only asking for support, but we may have to give some, and if you do not have a common denominator in speaking the same language you just do not get anywhere.

Mr. LIPSCOMB. We have had testimony before this committee both ways. I believe we had one important military officer of the Government testify that there were no plans that were kept secret, and yet I believe we had other testimony that said they were secret. So I do not believe we have straightened that out ourselves yet.

Mr. HOLIFIELD. I have at this point referred to some notes. Dr. Ralph Lapp, quite a noted physicist and author of articles on nuclear subjects, appeared before our committee and testified, as follows. He said:

> The fact that there was practically a delay of almost 1 year before the American people were given the information on fallout is bad.

I then asked him the following question:

> And is it not impossible to have an adequate civil defense unless this knowledge is made known to the people.

Dr. Lapp responded and said:

> I think this is probably at the core of the civil defense problem, that if the people do not know what to defend against, they will not have any real confidence that they can defend adequately.

Then I said:

> Do you know any reason from the standpoint of our national defense why the full knowledge of the impact of nuclear weapons should not be made known to the American people?

His response was as follows:

> If we consider the effect of high-yield nuclear explosions, I see no reason why these data about the effects cannot be given to the American people, for both the Russians and we have tested such weapons. They know what they do and I don't think we are keeping any secrets from them.

Mr. STARK. One of the fields, Mr. Chairman, that we think particularly we would like to have some information in—there have been some recent indications that surface bursts produce the effects of an earthquake. We think this is very vital to us in this area, particularly serving on top of the San Andreas fault, and we have no way of confirming or getting additional information as to the full extent of this effect.

Mr. HOLIFIELD. This is again an instance of newspaper headlines misleading the people and giving them part truths and half information rather than having the information on ground tremors given out from an authoritative source.

Mr. STARK. That is right, sir.

Mr. HOLIFIELD. Of course, I can say from my own knowledge that the newspaper stories and headlines were extreme. They were overemphasized.

There is a certain amount of ground tremor, but nothing so severe that it goes out for miles and miles and miles. It goes for a certain distance. Of course, I agree with you that this information ought to be released, the exact information. I am not privileged to release the exact information, but I can say that the newspaper articles overemphasized this factor in the way they were written.

Mr. STARK. To possibly answer Congressman Lipscomb a little more there, I was particularly referring, Congressman, to the fact that when these military plants and these installations are classified, we think it is proper and right that they should be, but we conversely state that we cannot help to support their planning if we are unable to know what it is.

So I think that is the point, sir, if I did not get it across well before.

Mr. LIPSCOMB. No. You got it across.

Mr. LYNCH. May I comment on that, also? I just want to assure you that we have in this area a joint military-civil defense committee, and that we are working very closely with the military in this area, primarily on the unclassified portions of it, and through good relationship we are building up with the military, working with them on a State and area basis here; we are getting little portions of what their planning is, and they of ours, of course, so that we can try to work together as a team.

But obviously, as Mr. Stark has pointed out, there is a great deal of that material which they cannot release to us, which still leaves that blank area there.

Mr. HOLIFIELD. But if you had a master plan which was approved by top level Federal authorities in both the civilian and military part of our Government, you would have the confidence to go ahead and do certain things without explanations which might run into security if you knew that the master plan was an approved plan?

Mr. LYNCH. That is correct, sir.

Mr. STARK. I might also apologize here that several of these, again, are going to be repetitive, but perhaps it makes for emphasis.

Mr. HOLIFIELD. You have about 10 minutes and then we will adjourn for lunch and come back.

Mr. STARK. All right.

Planning must be devised to permit flexibility according to the needs of each target area. In this respect, a planning policy of evacuation does not satisfy the requirements. The definition of the word "evacuation" implies the complete emptying of the area. Such a policy can only be accepted if there is a realistic capability of accomplishment of the objective.

We think planning must incorporate realism and accept potential casualties. It must be recognized that if an enemy is going to launch an attack upon the United States, he will do so under the times and

We are going to hear testimony from them on radiological matters, including the recovery of shore installations.

At this time, Captain Hinners, you may proceed.

Do you have prepared testimony?

Captain HINNERS. Yes, I do have, Mr. Chairman.

Mr. HOLIFIELD. You have submitted copies to the committee, have you?

Captain HINNERS. I gave a copy to your staff before lunch.

Mr. HOLIFIELD. You may proceed.

STATEMENT OF CAPT. ROBERT A. HINNERS, COMMANDING OFFICER, UNITED STATES NAVAL RADIOLOGICAL DEFENSE LABORATORY; ACCOMPANIED BY DR. PAUL C. TOMPKINS, SCIENTIFIC DIRECTOR; AND WALMER E. STROPE, HEAD OF THE MILITARY EVALUATIONS GROUP

Captain HINNERS. This statement covers the salient features of those studies, of the many that are underway at our laboratory, which we understand might be of particular interest to your committee.

The mission which has been assigned to the United States Naval Radiological Defense Laboratory, stated briefly, is to conduct research on the effects of hazardous nuclear and thermal radiations (including various interrelated effects) resulting from an atomic explosion or other nuclear processes; to develop and evaluate equipment and procedures for defense against radiation effects; and to prepare data for training purposes required by the military services, including assistance to other Federal agencies in the field of atomic and radiological warfare.

Mr. ROBACK. Captain Hinners, may I interrupt you from time to time?

Do you have a formal statement of your mission?

Captain HINNERS. Yes we do, Mr. Roback.

Mr. ROBACK. Is it sufficiently brief to read into the record at this point?

Captain HINNERS. I believe it is, sir, if you prefer. I was summarizing it. But if you would like the entire statement, I will give it to you for your files, if you wish, sir.

Mr. ROBACK. Submit it for the files and, with the chairman's permission, we will insert it in the record at this point.

Captain HINNERS. Yes.

Here are several copies which you gentlemen might like to have.

Mr. HOLIFIELD. Very well.

Captain HINNERS. That is over the signature of the Assistant Secretary of the Navy.

(The document above referred to is as follows:)

SECNAV 5450
Op–213C
Ser 4293P21

DEPARTMENT OF THE NAVY,
OFFICE OF THE SECRETARY,
Washington, D. C., November 1, 1955.

SECNAV NOTICE 5450

From: Secretary of the Navy.
To: Distribution list.
Subject: United States Naval Radiological Defense Laboratory, San Francisco, Calif.; established status and change in title of officer in command.

1. *Purpose.*—The purpose of this notice is to reafirm the established status of the subject activity and to change the title of the officer in command.

2. *Established status.*—The established status of the following activity under a Commanding Officer and Director Vice Commanding Officer is hereby reafirmed: United States Naval Radiological Defense Laboratory, San Francisco 24, Calif. 3865–825.

3. *Command relationship.*—The subject activity is a component of the United State Naval Base, San Francisco, under the military command of Commander, United States Naval Base, San Francisco, unless otherwise directed by the Chief of Naval Operations, and under the management control of the Bureau of Ships.

4. *Mission.*—To conduct basic and applied research on the physical and biological effects of hazardous nuclear and thermal radiations, including interrelated effects of such shock or blast and the dispersion and contaminating effects of fission products resulting from an atomic explosion or from controlled nuclear processes; develop and evaluate radiac devices and shielding equipment or materials for protection of personnel, reclamation or decontamination procedures for shipboard, aircraft, and land areas; preparation of data for training information required by the military services, including assistance to other Federal agencies and Government contractors in the fields of atomic and radiological warfare; and develop the use of radioisotope and other tracer techniques in the above technological fields.

5. *Implementation.*—Bureaus and offices concerned take necessary action.

6. *Cancellation.*—This notice may be retained for reference purposes, or canceled when no longed needed.

R. H. FOGLER,
Assistant Secretary of the Navy (Material).

Captain HINNERS. To accomplish this mission, the Congress has seen fit to provide us with some unusually fine physical facilities, and also with the means by which we have been able to assemble an outstanding staff of scientists and engineers for work in this field. For the benefit of those members of the committee and staff who were not able to visit us in San Francisco last week, I have here a photograph of the main building of the laboratory, which I will ask Mr. Strope to display.

That is the building that was formally dedicated last October in San Francisco.

Our total plant value, including certain satellite facilities, not shown in that photograph, is approximately $12 mililon, and our annual operating budget is about $5 million, including the cost of our participation in atomic weapons tests. Our staff consists of approximately 600 persons. It includes a few military specialists from all three of the armed services and a much larger number of civilian scientists and engineers representing both the physical sciences and the biological and medical sciences.

The laboratory was born as the result of the findings at the first atomic tests at Bikini in 1946 and we have been pursuing our mission for the past 10 years. The results of our studies over this period have convinced us that a high measure of effective passive defense against atomic attack is technically feasible—in other words, the technical means with which to greatly improve the protection of our populations from the consequences of nuclear warfare are within our grasp.

We believe such measures to be important because we note that many well-qualified witnesses who have preceded us before this committee have recognized the fact that some enemy weapons may get through. Passive defense begins with the assumption that the weapon will be delivered to the target. Passive defense then consists of all measures taken to minimize the effects of the attack when it occurs.

A major result of our studies has been to show that the problem of passive defense must be broken down into three subproblems or subobjectives. The first of these is survival—survival of both personnel and facilities. This is an extremely important objective, but the simple process of survival is not a sufficient answer to the problem of passive defense, especially in view of the effects of modern nuclear weapons. In addition, we must devise means for the early recovery of our essential wartime military and civil functions, and for the ultimate recovery of a satisfactory way of life.

In our studies, we, therefore, regard passive defense after nuclear attack as consisting of three time-phases of action. The first is the emergency phase, with survival as its objective; the second is the operational recovery phase, with the objective of early recovery of essential functions; and the third is the final recovery phase, with the objective of ultimate recovery of normal functions. Where attacks occur on either Military Establishments or on civilian populations, we believe that the emergency phase will begin upon warning of attack, if such occurs, and will last for several days to weeks. The operational recovery phase will then begin and last for many weeks to months. The final recovery phase may last for many years.

Mr. ROBACK. Captain Hinners, may I interrupt and ask you this, at this point?

Captain HINNERS. Yes.

Mr. ROBACK. From the standpoint of operational analysis, does it make any sense to divide the agencies that are responsible for these postattack phases as between, let us say, one that deals with immediate emergency, and one that deals with a long-range recovery?

Captain HINNERS. I would say this, Mr. Roback, that if there are policy or political reasons why they must be divided, or should be divided, then it obviously would be essential that there be perfect coordination between the different agencies that are assigned these different phases of the problem.

There are a certain number of bodies, or a certain number of people, and a certain type of technical knowledge, which is going to be required to handle each of these phases, and it is essential that they work in close coordination and with an adequate amount of preplanning as to what they will do when that stage is reached.

Does that answer your question, Mr. Roback?

Mr. ROBACK. That is all right, thank you.

Captain HINNERS. There are, of course, a large number of types of countermeasures that are available for us in passive defense. Among the more important are dispersal, shelter, damage-control actions such as firefighting, rescue of injured and medical aid, reduction of target vulnerability, and radiological reclamation. It has been our purpose to evaluate the relative abilities of these countermeasures to achieve the desired objectives. In particular, we have asked ourselves: Are there particular countermeasures that, by virtue of their high degree of effectiveness and wide applicability, deserves to be singled out as the keystones of an atomic defense system?

From a considerable number of detailed studies of atomic defense problems, we have concluded that such key countermeasures do exist.

I might interpose at this point that upon the conclusion of my statement and at the pleasure of the committee, Mr. Strope will give some of the measures and some specific examples of how we have arrived at these conclusions, and also Dr. Tompkins.

We have concluded that adequate shelter is the primary key to survival under atomic attack and that reclamation is the key to early resumption of essential functions. We regret to say that the state of knowledge concerning the problems of final recovery does not appear to be sufficient at present to permit as specific a determination of a key countermeasure for that phase, but it obviously will have to be based on some means of radiation exposure control.

Thus we believe that an effective passive defense can be achieved by means of a phased countermeasure system built around the existence of adequate shelter and an ability to reclaim (and, if necessary, repair) the essential facilities in the target area. The importance of approaching the needs of passive defense as an integrated system rather than an agglomeration of individual measures cannot be overemphasized. In this regard, we desire to make two major points with reference to the atomic defense system:

First, when we single out adequate shelter as the key to atomic survival, we do not mean to imply that by itself it will do everything that could and should be done to minimize casualties. The other countermeasures have their place and will make important contributions. But we do mean to contend that without adequate personnel shelters all atomic defense efforts are likely to prove to be ineffective; while with adequate shelter, the other countermeasures such as dispersal and its variant, tactical evacuation, firefighting and rescue work, reduction of vulnerability and the like become feasible and productive.

Second, we wish to stress that, as in all systems, the interactions among the various parts of the system are extremely important.

For example, shelters are for survival but if they are designed for bare survival, the ability to accomplish the phases of recovery become virtually impossible if fallout occurs. Each person has a limited exposure to nuclear radiation that he can sustain without becoming a casuality. If we spend all of this spender stock in the emergency phase, we cannot spend it again.

Therefore, the question of what constitutes adequate shelter (and indeed, what constitues an adequate performance of any countermeasure) depends on a careful analysis of the system as a whole. Otherwise, what may appear to be an adequate atomic defense will be found wanting when an attack actually occurs, with disastrous consequences.

Mr. ROBACK. At this point, Captain Hinners, does it not also follow from your statement that a great deal of civil-defense effort could be economically wasteful if it is not within that system?

Captain HINNERS. Well——

Mr. ROBACK. So that one could not necessarily place on the credit side a whole list of the things that have been done from time to time?

Captain HINNERS. It is the case of, to use an analogy which I know Mr. Strope likes to use in another manner—it is the case of a chain being as strong as its weakest link, and if, as we contend, adequate shelter is essential to achieving the payoff with the other measures to which I believe you were referring, then lacking the adequate shelter, at least temporarily, it seems to me that it would be economically wasteful to go ahead with the other measures unless it was definitely intended to achieve the shelter, also.

Mr. ROBACK. I assume from the concept of shelter as a certain countermeasure, it would not follow necessarily that all your efforts are in a link. What I am trying to get at in this question is, if you do not have the key links identified, can you have a chain? And if you do not have a chain, doesn't it follow that a lot of these efforts could be economically and strategically wasteful, so that if you run off in one direction and you spend money, let us say, for emergency supplies without a theory of the role of emergency supplies, you are not necessarily doing anything useful?

Captain HINNERS. I believe I understand your question better now, and I believe I can cite an example of perhaps what you mean.

It is quite possible to go perhaps too far in procuring a certain type of radiation detection instrument which, at first glance, might look as though it might be valuable in an emergency, because it would detect radiation, but until the system as a whole was considered, and you determined what range of instrument, since you cannot have a whole family of them, what range of instrument you really needed for the universal needs of passive defense, then I believe money could be wasted that way if that is an example of what you meant.

Mr. ROBACK. Yes.

Captain HINNERS. I have just mentioned that unless the system as a whole was considered, what appeared to be an adequate atomic defense might be found wanting.

The reasons for this, as we see them, are set forth in a technical report (No. TR-74) which was published by our laboratory early this year. It is entitled "Radiological Defense Measures as a Countermeasure System."

Mr. ROBACK. Do you have a copy for the record?

Captain HINNERS. I do, sir.

Mr. ROBACK. Will you please submit that, with the chairman's permission?

Mr. HOLIFIELD. You may submit the same.

This is an unclassified document, is it, Captain?

Captain HINNERS. Yes, sir.

(The report referred to is contained in the appendix, exhibit 3, p. 2584).

Captain HINNERS. In conclusion, it is our opinion that the development of an effective passive defense system is feasible. However, the technical problems are difficult and justify the best professional leadership available. It is not within the purview of a research agency such as our laboratory to comment on what should be the relationship between the Nation's civilian defense organization and other components of the civil government and the Armed Forces. We do wish to stress, however, our belief that the early achievement of an effective passive defense system is important in assuring our national survival.

Mr. ROBACK. Captain Hinners, before we get into the testimony of your associates, I would like to ask you a few questions. If you feel in any case that they will answer them, or that it will be covered later, please so indicate.

Captain HINNERS. Yes, sir.

Mr. ROBACK. Now, it is a fact, is it not, that the mission of your laboratory is not necessarily limited to specific Naval functions?

Captain HINNERS. That is correct, Mr. Roback. I think I should clairfy one point there.

As I indicated in my summary of our mission, and as is shown in the more complete statement of mission I gave you for your files, our mission includes specifically assistance to other Federal agencies in the field of atomic and radiological warfare.

However, as you probably know, the formal mission which is assigned to an Armed Forces field agency such as our laboratory is intended to be the overall boundaries within which we are permitted to operate without having to go back to considerably higher authority to get permission, you see, to go beyond those boundaries. It does not mean that as of any one year, or at any one time, we will be doing everything that might be implied by the statement of the mission. That depends on the program that has been assigned to us, the personnel that we are able to acquire within the limitation of funds, and various other day-today considerations of that type.

Mr. ROBACK. But in concept and organization, aside from the facilities required for the carrying out of any specific mission, in concept and organization your laboratory comprehends the whole field of atomic defense, does it not?

Captain HINNERS. We consider that it does, particularly, for example, because I believe that we are the only laboratory that has in substantial numbers working as an integrated team under a single scientific director, personnel in both the biological and medical scientists and in the physical scientists, chemistry and physics.

Mr. ROBACK. Do you know of any agency in Government, in the Department of Defense, the FCC, the AEC, the FCDA, or any other, that comprehends the fuctions that you perform?

Captain HINNERS. I do not know of any that has them, certainly within a single building and within a single scientific department, such as ours.

Mr. ROBACK. To what extent, if any, do you overlap or duplicate conditions of the Atomic Energy Commission?

Captain HINNERS. Our observation has been, and perhaps I should mention that I believe our laboratory was probably the first Armed Forces field agency to enter into a reciprocal arrangement with approval on both sides, with the Atomic Energy Commission for exchange of technical reports. Such a reciprocal arrangement was achieved a number of years ago, and by that means for a number of years our people have kept themselves informed of the work going on in the AEC's laboratories, and also through direct exchange of visits and liaison. And it has been our observation that the mission assigned to the Atomic Energy Commission, first and foremost, of course, has been to develop the weapons for our national defense arsenal in their field.

However, they have done a great deal of work in the field of radiological hazards, which I believe stems originally, at least, from their concern for the safety of their production workers in their various establishments, and also their concern and I believe their legal responsibility for the safety of the general public in connection with any of their operations, be they these operations or be they production operations, such as up at Hanford.

For that reason, I believe that there were concentrated on the effects of relatively small amounts of radioactivity sustained over long periods of time, such as is associated with that type of industrial or peacetime operation.

Where they have had a problem of possible hazard, I believe it also will be found that they control that by telling the individual concerned, "If your instrument reads more than a certain amount, don't go in there; just wait and let it cool off, or use remote-control apparatus, or something like that."

On the other hand, the military found when it was getting into this field that certainly in time of war and in time of emergency rescue, if you want to apply this to civilian defense, there would be many situations where it would be quite unwise to tell a man in advance, "If your instrument reads more than a certain amount, don't go a step farther," because the mission might require a person to go farther.

So the Armed Forces had the problem of determining, if we must do that, then what are the effects going to be? And what is going to happen to them with these much larger doses of radiation, so that at least the military commander, who has to make command decisions on the spot, will be able to do so with his eyes open and know what he is getting into.

That certainly, in the biological and medical field, I think, is the best way that I can explain the role of our laboratory.

I would just like to cite an analogy which might help to get the point across a little bit better.

To tell a military commander in time of war that he must not have his troops go into an area where the instrument reads more than a certain amount, would be equivalent to telling him that he should never let his troops expose themselves to machinegun fire which exceeds a certain number of bullets per minute, per square yard.

The principle is the same, and yet, early in the game there was a tendency not to realize the principle which I hope my example has just pointed out.

Mr. ROBACK. Now——

Capain HINNERS. Mr. Roback, would it be permissible for Mr. Strope to add something to this?

Mr. ROBACK. Of course.

Mr. HOLIFIELD. Certainly.

Mr. STROPE. I would like to add simply that this very difference between the problems of production and industrial use of atomic energy and not only the military problems, but the civil defense problems, are so distinct not only in terms of what happens to people under these more massive dosage commissions, but what is really the payoff of our mission: How do you get the job done without losing these people under those conditions?

Mr. ROBACK. Now, you are the head, Mr. Strope, of the military evaluations group. Is there any other agency in the Department of Defense or outside that makes such evaluations?

Mr. STROPE. I would like to point out that this is in the area of what is now known as Operations Research.

Mr. ROBACK. Operations Research in radiological defense?

Mr. STROPE. There are, of course, a number of very fine organizations in this field at the present time, many much older than we are. There is none that is devoted exclusively to this problem of atomic defense, and there is none who have at any time devoted anything near the scale of effort that we have devoted to the problem.

Mr. ROBACK. Now, I would like to get an evaluation of the relationship of radiological defense to civil defense. I mean, are those almost synonymous problems? What is the magnitude of importance in the relationship?

Mr. STROPE. Let us say this, and I think that a little later in the testimony this will be clear, that we regard radiological defense, which, of course, is that part of passive defense or civil defense that is concerned with the defense against nuclear radiations, to be an extremely important part of the problem, and has become increasingly important over the past few years.

Mr. ROBACK. Are you aware that the Federal Civil Defense Administration has made a contract with the University of California to study this area?

Captain HINNERS. Yes; we are.

Mr. ROBACK. And it would follow from your statement as to the magnitude of the importance that they have, in effect, you might say, contracted with an agency to study a broad area of their statutory field of jurisdiction; would that not follow?

Captain HINNERS. If their contract with the university covers essentially their total research and development effort in the radiological defense field, that would be true. I am not sufficiently familiar with the exact scope of their contract with the university—I have never seen the contract—nor with other efforts which they may have underway within their own staff, to be able to answer that question.

Mr. ROBACK. You are not consulted in any manner before the letting of that contract?

Captain HINNERS. I——

Mr. ROBACK. I mean, directly by the responsible contracting parties.

Captain HINNERS. If by that you mean whether we were asked for our opinion as to whether the contract should be consummated, we were not. We were, however, apprised of the fact that the contract was being negotiated by a representative of the Civil Defense Administration who happened to visit us from Battle Creek early this year, and he mentioned to us that one of the reasons why the university was being considered was that they felt that its proximity to our laboratory would lead to an advantageous opportunity for collaborative effort.

Mr. ROBACK. Do you mean that the university would come to your laboratory and obtain advice or technical assistance in the performance of the contract? Is that what you mean?

Captain HINNERS. They were referring to an opportunity for consultation, or exchange of ideas, as I understood from the gentleman.

We have found that when we have these liaison exchanges, as we frequently do from other agencies, such as Rand & Sandia Corp. people, that it is never a one-way street, and we never worry about who gets the most from whom.

We usually feel, in retrospect, after we have had a visit from people like that, that at the same time that we helped them to learn something, we have learned something from them. And we welcome those types of association.

Mr. ROBACK. You have never seen the articles, the terms of reference, or the scope of the contract?

Captain HINNERS. No, sir.

Mr. ROBACK. I will try to indicate to you briefly what the scope of the contract is, since apparently it is new information to you, and ask you the extent to which, if you had been approached by the Federal Civil Defense Administration, you could have successfully, assuming the addition of necessary funds, facilities, and personnel, have carried out this type of investigation.

The scope of the contract, according to its terms, places upon the university the obligation of undertaking the initial study and research necessary to furnish the basis for design and development of the organizational system necessary to execute a national radiological defense plan, taking into consideration the organizational structures already established.

Now, that is the broad scope of the contract. Now, does that convey an operational meaning to you?

It may help you in answering by saying that this initial study and research, the contract goes on to recite, shall include, but not be restricted to—and the first item is—

comprehensive determination, review and analysis of the present status of radiological defense and its relation to overall civil defense and weapons development.

Then it goes on to specify a review and analysis of programs for better prediction of fallout patterns, for the identification of tests and experiments necessary for radiological defense, for review and analysis of shelter and evacuation program and the most satisfactory use of cover; review and analysis of various programs for selecting, securing, distributing and using radiological instruments; review and analysis of the communication systems for the control of radiological defense; review and analysis of the practical means of radiological decontamination on a large scale; review and analysis of the present body of knowledge related to the prophylaxis, diagnosis and treatment of radiological injury; review and analysis of internal radiation hazards created by inhalation or ingestion of radioactive materials; determine and conduct such development and research on methods and equipment either directly or by subcontract subject to the approval of the Government, et cetera.

Now, what I want to know is, is that a manageable contract to be contracted by a Government agency, based upon your knowledge of the operational requirements of radiological defense?

Captain HINNERS. I would certainly say that it is a large order. I think I can best answer your question if I will indicate to you the enumeration which I made, as you read the different categories of investigation and the estimate I made of our capability of undertaking those fairly soon, with some augmentation of our existing staff.

A review of the present status of radiological defense, so far as its techniques and the technical aspects of it are concerned, I would consider that our laboratory is as much up to date on that now as any existing agency.

A program for better prediction of fallout is something that we have devoted considerable effort to for some years now, and we are making some progress on that.

Our biological and medical program, as two of your committee members had occasion to observe last year, has been studying methods of prophylaxis and treatment of radiological injury.

However, I find in your enumeration some other items which we would not exactly have to start from scratch on, but for which tremendous amount of data not now in our hands certainly is going to have to be assembled by some people to tackle it, and it would be a big job.

I refer to the shelter-evacuation program. As I understand it, handling that in a comprehensive manner would require survey-type information of the existing shelter facilities in the areas of interest on a nationwide basis.

Mr. ROBACK. Doesn't that comprehend in effect, at least, the first phase and possibly the second phase of your whole countermeasure system?

Captain HINNERS. It certainly does. It brings in quite a large bit of territory.

The situation as to where instruments should be disposed, if that is to be applied to the civil defense, would require a knowledge of the detailed organization as it is tied in with political subdivisions throughout the United States, which we do not pretend to have in our laboratory. It would probably take our whole staff a while to assemble that or assimilate that, and similarly in communications, we are not communications. I was interested in the item of decontamination——

Mr. ROBACK. May I interrupt there?

Captain HINNERS. Yes, sir.

Mr. ROBACK. On those last two items you cited, are you stating that the order of problems that would be posed is essentially quite different from the order of problems posed by the other elements of the system?

Captain HINNERS. Well, let me just say that it seems to me that they require a different type of technical skill. However, the facilities of the university are rather broad, I believe, in that respect. The shelter people, in other words—you need civil engineers and architects among others. Our laboratory staff has one naval civil engineer, a project officer, on my staff, and a few other people with structural backgrounds, but not very many, not in the numbers in which it seems to me they would be needed for this. And we do not get into communications directly. We have some people in our laboratory who know something about it because they are electronics engineers and scientists and they have worked in communications, but they are not doing it for us.

Now, in the decontamination category, which is the only other one that I recall that you mentioned there, facilities and techniques for large-scale decontamination, in our opinion, have yet to be developed experimentally, as well as through survey and operations analysis means.

That is the reason, in fact, why the first large-scale decontamination exercise using tracer elements, which, to my knowledge, will have been carried on anywhere, is going to be carried on up in our area this fall under a joint project between our laboratory and the Army, that is, with Army support, from the presidio.

Mr. ROBACK. Mr. Chairman, at this time, if we may, I would like to get the testimony of Captain Hinners' associates, and some other questions may come out of that.

Would you like to indicate the areas of subject matter that you have discussed and that you have made some preparation for?

Captain HINNERS. Before Mr. Strope does that, I believe I would like to have Mr. Strope follow me, if I may. For the record, I would like to introduce Mr. Strope as the key member of our staff who is responsible for the application of the results of our research to the technical problems of the armed services.

He has been in this business for a long time. He actually started in the capacity of a naval architect during World War II when he was engaged in war-damage analysis with the Navy Department, and that led to his membership in the Navy technical staff in Operation Crossroads, in Bikini, and that led him into the atomic-defense field.

He has been at our particular laboratory for 8 years in this capacity.

Mr. ROBACK. You may proceed, Mr. Strope.

Mr. STROPE. Captain Hinners has presented very briefly the key concepts of the general system of atomic defense that has become apparent to us as the result of extensive studies over the past 5 years.

It is my purpose to make a few specific statements about atomic effects and the comparison of countermeasures in an effort to justify and extend the concepts presented and then to discuss briefly the major implications that we see with reference to civil defense.

We have been principally concerned with the problem of radiological defense and the problem of defense against the fallout from atomic weapons in particular.

Our studies of this problem since Operation Crossroads have convinced us that fallout is the major antipersonnel effect of nuclear weapons. That is, if an enemy desires to kill people, he can do so most effectively by bursting the weapon on or close to the surface so as to produce a heavy fallout.

Mr. ROBACK. Now, may I interrupt? And if you cover this later, please so indicate.

Mr. STROPE. Yes.

Mr. ROBACK. Does it follow as an operational requirement that this concept of fallout—and here I am going to take issue with the chairman—that this concept of fallout requires planning which is not geared to the concept of a target area? In other words, the operational requirement comprehends all possible targets and it does not place a primacy on given targets?

Mr. STROPE. As I understand your question, I agree.

Mr. HOLIFIELD. I think I will have to cut in here.

I want the record to show that I am not in conflict with Mr. Roback's position. My position in regard to shelter would be that wherever radioactive fallout occurs, this shelter must be provided.

I would take the position, however, in line with the importance of possible target areas, that there should be priority established on those areas where it would be most likely to occur in an intense manner, and therefore the shelter should be provided in the target areas or near the target areas first, rather than out many, many miles away, not that the possibility of contamination might not occur many miles away, but that the problem would be more urgent in the target area than outside of the target area.

That would be my position on that.

Mr. ROBACK. Mr. Chairman,we were not really arguing. I was just trying to get a clear understanding of what would be the logical consequence for operational planning of the widespread fallout pattern.

So at least you have testified, as far as fallout is concerned, that the problem of planning for fallout comprehends the entire potential target area, which would be the United States, presumably?

Mr. STROPE. I think that I would prefer to consider this question somewhat later in the discussion.

Mr. ROBACK. All right.

Mr. STROPE. I would say this, that while it is generally true that the effects, any effect, of atomic weapons falloff with distance—blast, heat, and so forth—the falloff of the lethal potential of fallout with distance in the downwind direction is extremely slow and for a large region is nonexistent.

What I would like to say here, and just leave it at that, is that a megaton surface burst on the city of Washington is quite likely to kill everybody in Philadelphia. In other words, the difference between being the target city and not is not likely to be of significance in terms of the present situation.

I think we had better leave it there for the moment. I would be glad to come back to it after I have had an opportunity to present the line of thinking that we have developed for your possible use.

Now, as I said, we have been convinced that fallout is the major antipersonnel effect of the weapon, and this fact has become generally recognized in the past 2 years. For example, the Federal Civil Defense Administration planning assumptions for fiscal year 1956, which have already been introduced into the committee records, state in part:

> It is assumed that some of these weapons will be detonated in the air and others at ground level. If detonated at or near the ground, radiological contamination will be produced in areas far beyond the zone of the blast and thermal damage. Nuclear weapons detonated at or near the ground—

I am quoting now from a paragraph about two paragraphs beyond in the planning assumptions—

> Nuclear weapons detonated at or near the ground level, particularly those of high yield, cause residual radiation in lethal concentrations over areas far beyond the radius of blast and thermal effect.
>
> Radioactive fallout intensities dangerous to persons who do not take protective measures can be carried by the wind in the upper atmosphere for a considerable distance downwind from Surface Zero. It is therefore regarded as probable that this type of burst will be used for such weapons.

That is, FCDA believes that most large-yield weapons will be burst at the surface with resulting fallout, and these are assumptions with which we concurred.

Most people now recognize the fallout hazard from megaton-yield nuclear weapons. What is less recognized is that fallout is the principal antipersonnel effect for all weapon yields.

The fallout hazard is not peculiar to high yield weapons. It is only the very large regions affected that have commanded attention.

Mr. ROBACK. May I ask at this point, you state that that is an assumption recognized by the FCDA. Do you have any evidence that that assumption was ever used for any operational planning purposes?

Mr. STROPE. I am not a competent witness in that respect.

Mr. ROBACK. I asked, have you ever heard? You can answer whether you heard or not.

Mr. STROPE. I have a fairly wide range of contacts in civil defense, both at local levels up through the Federal Civil Defense level, and I would have to say "yes," that these types of assumptions are in the minds of most of the people whom I regard as being of significant influence in those areas.

Mr. ROBACK. I asked you, do you know of an operational plan today which embodies or comprehends that assumption?

Mr. STROPE. Negative.

Now, while our principal efforts have been directed toward radiological defense, we have been alert to the problems of defense against the other effects of the weapon.

I might interject that the mission requires us to investigate these various other effects and, of course, it would be rather stupid of us to ride off a hobby horse in terms of nuclear effects unless we recognized the areas in which it was dominant.

The framework for atomic defense that we have just presented, and which I desire to extend and justify, gives due recognition to the importance of radiological defense. But it is of general applicability to all types of nuclear attack and in all targets.

Now, to go into this to a point where I think we can have a profitable exchange of views, a fundamental requirement of any passive defense system is that it must be sufficiently flexible to deal with a whole range of situations in which it proposes to be effective.

In particular, there are certain assumptions regarding the general attack situation that cannot be made restrictive without infringing upon this requirement of flexibility.

And these are—and I am going to put them on the blackboard for discussion purposes, as follows:

1. Yield of weapon;
2. The type of attack—by this I mean principally whether it is a high air burst or surface burst or harbor burst, or whatever;
3. The number of weapons delivered;
4. The point of attack;
5. The time of attack;
6. Warning of attack; and finally
7. The existence of central control.

Mr. ROBACK. Before you go into the discussion, for the sake of clarification, are you going to contend that your planning must not be restricted or limited by any assumption regarding any of those seven points?

Mr. STROPE. Our contention is that a fair judgment of any plan is the degree to which it is independent of these items.

Mr. ROBACK. Have you ever seen such plans and assumptions as have been made from year to year by the Federal agencies or any other agencies—is it not a fact that they have violated, you might say, any number or any one of these requirements?

Mr. STROPE. I propose to go into detail on one of these plans in comparison with a plan that the Navy has, which was a conscious effort to avoid this situation.

Mr. ROBACK. Thank you.

Mr. STROPE. Can you hear me all right when I am out here?

Mr. HOLIFIELD. Yes.

Mr. STROPE. I would like just quickly to indicate, if necessary, the meaning of these.

In other words, a plan for atomic defense should be independent of the yield of the weapon. For instance, we are familiar with the early days of atomic defense, when everything was geared to a 20-kiloton explosion.

A plan that is geared to any size is a weak plan in that respect.

At the same time, it must be independent of the type of attack, whether it is a high air burst, a harbor burst, or a surface burst, or whatever.

The significance here is that the role of the various effects of the weapon varies with the type of attack, and whether we start making fixed assumptions as to what the type of this attack may be, we can get into trouble.

The number of weapons delivered. I think this is rather obvious. Most plans that I have seen unfortunately will handle one weapon.

Fourth is the point of attack, and this is a sore point. People consistently decide where the enemy is going to deliver the weapon and base all of their planning upon this aspect. Also, in selecting this point of attack, there is a tendency to regard a certain time of day as the logical time for attack, and one thing that we must be on guard against is whether the enemy is logical in that particular way.

Warning of attack: Of course, we would like as much warning as we can get. But the meaning of this in terms of a plan is that the plan should provide a high degree of readiness in the no-warning condition.

Clearly if we have warning we can do better, but the plan must be one that is effective as possible in the no-warning situation.

Mr. ROBACK. Mr. Strope, it is clearer and easier to plan when you can assume away the tough obstacles; is that not the case? It is cheaper and easier to plan, the more of those limitations you impose upon yourself?

Mr. STROPE. Yes. You can arrive at a simple plan——

Mr. ROBACK. In which the responsibility falls on the individual and the Government spends no money, for example.

Mr. STROPE. I am again not competent to discuss that; I don't think so.

The final one, which is extremely important, is one that perhaps for all I know is more pertinent to the military problems we have been dealing with than civil defense, although I would be surprised if it is not also a problem of civil defense, namely, the dependence on central control.

There is an alarming tendency to have the things that have to be done wait until somebody presses a button and says, "Go to it." And if there is anything that makes a plan valuable, it is the ability of it to be self-starting when something happens.

This element creeps into too many plans, that you will only put this plan in action when Joe Blow phones you and says, "Do it." Well, unfortunately Joe Blow may not be there. or the communications may not be around.

Mr. HOLIFIELD. On that point, we understand that when we had the so-called yellow alert here on the coast last year, all of the civil defense directors in southern California were having a convention somewhere, and they were not there to exercise central control in their respective communities.

Mr. STROPE. That is very interesting. But civil defense does not have a priority on that sort of situation. That can happen anywhere. [Laughter.] Those are the seven things. And in talking about this, which I have done quite a bit to various organizations, I have called these the seven deadly sins of atomic defense planning. That is a little dressy, but it gets the point across.

Now, I would like to cite a specific example. First of all, I would like to make one more statement that you are going to hear, and it sounds like scientific gobbledegook. But I assure you it is not. I hope by the time I get done, you will agree that it is not.

When a plan makes specific assumptions on any or all of these points, we call the plan a weapon-oriented plan or system, a weapon-oriented plan.

And most of the resounding failures of passive defense—and there have been some—that have occurred in the past have resulted from weapon-oriented systems.

Now, an example that is familiar to practically every person is the Maginot line in France.

Now, there was a passive-defense system that was directed at a specific threat and a specific mode of attack. Unfortunately, much of the present planning for passive defense against atomic attack is also weapon-oriented, and we feel that it is likely to suffer the same fate as the Maginot line.

Now, I would like to take a specific example to show you in reality what happens when a weapon-oriented approach is taken, and I have in mind the FCDA publication, AG–8–1, which is entitled, "Principles of Civil Defense Operations" and was published in July of 1951.

Now, that was nearly 5 years ago, and I know from personal experience that the understanding the FCDA has increased considerably since then.

So I am not holding this up for ridicule or anything of that purpose. But it does happen to be an excellent example of a weapon-oriented plan, and I would like to use it as a comparison to a plan for the same subject which is not so oriented.

Mr. HOLIFIELD. Do you happen to know if that is still in circulation, being sent out by the FCDA?

Mr. STROPE. I do not. All I know is that we are on the mailing list for all FCDA documents. I have seen nothing that supersedes it. That, of course, does not demonstrate it.

Mr. HOLIFIELD. And you have not received the notice of recall?

Mr. STROPE. No, I have not.

This document presents a system for what I call damage control after attack. That is, the fire fighting, rescue, medical aid, et cetera, which a large number of people regard as civil defense.

This is one type of countermeasure in passive defense. And it proposes a system which they call a web defense, and this web defense is developed in the following way. It says on page 5:

> Before a web defense can be achieved, location of the most likely target and its logical avenues of approach must be determined.

So it starts out basically with choosing a probable point of attack.

I will read this, although it is not pertinent to the argument:

> Surveys and other information dealing with community industrial facilities and services will serve as a basis of evaluation. One factor to be considered is the value of the facility or the service to the national defense—

in selecting this point of attack. [Continuing:]

> Once the target is determined, the web defense is geographically organized into zones radiating from the assumed target center. Zone boundaries may be at the corporate limit of the area to be defended, but normally they should extend to the edge of the target area. The zone should be divided into middle, inner, and outer perimeter bands. The boundaries of the perimeter bands should be roads or streets which permit access between zones.

That is around the target.

You get a picture, if I can draw it up here, of an assumed point of attack, and peripheral roads which form this into bands, this being done as part of the planning prior to attack.

I would like to point out first of all that the very concept limits it to one burst, and that in general because it turns out and it is encouraged in here to be a circular plan; it is limited to a high air burst and not a fallout situation, and in general the dimensions of the things, as I have seen them, and which are used as examples here, limit it to a fairly moderate yield of weapon.

The point of attack chosen is generally chosen in a way as to fix the time of day at which that would be a logical target.

These two are not so 'clear, and this particular document does not mention the utility of the system being independent of warning or central control.

The applications of this that I have seen are generally at least partially dependent to wholly dependent on these factors, so that in general the system as it is set up, which assumes a target center and then cuts it up into pie-shaped slices and plans to operate that way, is what we call a weapon-oriented defense. And I think it is obvious that if the weapon is larger, or a surface burst, and particularly if it does not hit where they thought it was going to hit, that they are in very bad trouble in terms of operating after an attack this particular countermeasure which this is set up to deal with.

Now, I think that Admiral Burke introduced you to this particular document, the Navy passive defense manual, in which we are proud to say the philosophy was produced in our laboratory, which was published as USNRDL-450, entitled "Passive Defense Philosophy and Principles of Damage Control in Atomic Attack on Shore Establishments."

Mr. ROBACK. Does that have same classified material in it?

Mr. STROPE. No. It is unclassified.

But I want to read just a few points out of this document which forms the basis for the Navy's system to illustrate the difference in approach, which you will find carried through our whole approach to the problem of atomic defense and radiological defense.

Now, this plan—do you have a question?

Mr. HOLIFIELD. Excuse me. Are you reading from the document that you handed us?

Mr. STROPE. No. This is USNRDL-450, of which we can provide you with a copy at a later point. I think that Mr. Roback has a copy.

Mr. ROBACK. I have a copy.

Mr. HOLIFIELD. That is all right if we have it. We just wanted to identify the document for the record.

(The document referred to is contained in the appendix, exhibit 4, p. 2598.)

Mr. STROPE. Yes.

In this type of plan—this is called, incidentally, a target-oriented approach, and it is one that we think is absolutely necessary in atomic defense. In this case, we do not concern ourselves with the size of the weapon, the number of weapons, the point of burst, et cetera.

We turn first to the target and we say—and mind you, I would like to have you keep in mind that in this particular example we are talking about these damage control actions after attack—we say:

> Where is the source of the equipment and manpower to do these things?

And this plan being initially developed for the Navy says it this way:

> Each naval activity in the district or river command that is responsible for 2,500 or more military and civilian personnel is regarded as a cell in the district damage control organization—

and a damage control operating force is based on each one of these cells.

So in the target area, then, we have certain sources of manpower, and they are regarded as cells, and the organization is based in that fashion.

I think I might interject here one more thing, that so long as this is limited to the Navy, it has, we recognize, a limited effectiveness, because the Navy has a limited amount of effort.

Mr. ROBACK. I just want to develop that point for a minute. Is it not implicit in this kind of organizational analysis that it does not make any sense to limit it to one agency or one jurisdiction? The logic of it is that all agencies have to participate in the same plan, and the plan has to extend throughout the target potential?

Mr. STROPE. One of the advantages of that system is that the question of who works for whom in an emergency, the questions of jurisdictions over people, are largely eliminated by this system, provided everybody is organized on a cellular basis.

Incidentally, the technical title of this plan is a two-perimeter system based on a cellular defense organization.

The emphasis, though, that I want to make is that the first step is to look at the target and develop the cellular organization.

So if we had, say, the Navy, the Army, and the Air Force, and civil subdivisions on the same sort of basis developed into cells for this purpose, we would ultimately have the whole target area out to Timbuktu, if you want to go that far, organized in this cellular aspect.

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Now, where there are few people, it would cover a large region, obviously. Some of these would be military installations; some of them might be industrial plants that had that number of people. That number, incidentally, is an arbitrary one which is chosen so that the number of people that we can have effectively trained is big enough so that it is not just a splinter effort.

I might say that the concept of this passave defense force, which I prefer not to go into today because of the time, is organized in terms similar to a regimental combat team in the Army, a self-sufficient, fully operative force that has all of the functions necessary to get the job done.

Nevertheless, we have a large number of cells throughout the target area. Then no matter how many bombs and what type and where they drop, certain of these cells are going to be eliminated and certain others are going to be pinned down. There are going to be some that are going to be able to do something, and so if the burst happens here—and I would like to contrast this with the previous type of study—if the burst should happen there, then we find a set of periphery growing up dictated by the nature of the explosion, incidentally, and the type of effects that do occur, where this line, which incidentally might be something like that rather than circular, represents the boundary within which no operations are feasible, and the outer boundary indicates a relatively safe region where support functions can operate to support the people in here.

But with that very brief type of treatment of the differences between the two, we have attempted to develop, for this particular type of countermeasure, an organization that is relatively independent of any predisposition to decide where the enemy will drop the weapon, what type, what size, et cetera. And there is a great deal of effort put into it to make it self starting, to make it functional when warning is either very small or nonexistent, and without central control if this should fail.

This is not that we eliminate these, but we recognize that they may not occur.

So you see, we end up with what is a similar operating procedure but is now sufficiently flexible to meet all of the possible attacks that may occur.

Now, this is not to say that the plan will be effective under all conditions, because any passive defense plan and particularly any type of damage control effort can be saturated and can be submerged by a sufficiently massive attack. But what we believe in general is that this plan will permit full exploitation of the damage control possibilities. It will remain in effectiveness as long as can be possibly expected, and will do good work.

And we feel in general, with this merely as an example, that the whole passive defense system must be target oriented, as we call this sort of thing, rather than weapon oriented, if it is to be effective.

I have one more example——

Mr. HOLIFIELD. That is, taking into full consideration the fact that no one will know where the zero point burst is?

Mr. STROPE. I think we will go into that right now, because I think it is a very important point, and while sometimes the right answers come out, it is usually a matter of happenstance that it does so, when a weapon-oriented approach is undertaken.

One of the procedures for a target analysis that has been frequently used and abused involves starting with a decision as to where a potential enemy will deposit a nuclear weapon of a stated yield and basing all of the defense plans on the resultant conditions.

Now, such plans are ideal if the particular weapon yield in ground zero actually occurs. But very frequently a slight modification of the original assumptions drastically alter the conclusions regarding necessary countermeasures.

For example, suppose we are concerned about the possibility that Los Angeles will be attacked by an intercontinental ballistic missile. This has been discussed before. And it is bearing a high-yield nuclear weapon.

Now, this is often transmitted into a planning condition which says, for example, that there will be a 10-megaton nuclear detonation on, say, this very building that we are in, as the likely aiming point.

In such a case, this building and the surrounding area have been vaporized and only a crater remains.

Now, a careless conclusion from this type of aproach is that no defense measures can or should be undertaken in this building because, of course, it would be of no avail. But let us look a little further into this, because it is a key to a lot of the weapon-oriented thinking.

The accuracy of delivery of an intercontinental ballistic missile is not likely to be very great. With nuclear warheads, in general, it does not have to be very great, and the problem of achieving extreme accuracy are very difficult.

Certainly an aiming error of a number of miles is reasonable. It has been suggested by people that know quite a bit about this in the press. Take, for example, a CPE, circular probable error, of 5 miles, as a reasonable estimate. It is not based on any particular information, because we are talking here in an unclassified manner.

Now, if the enemy were to deliver an intercontinental ballistic missile with a circular probable error of 5 miles aimed at this particular building, then I would like to ask the question: What is the probability that if this building is at the aiming point, it would be in a region where shelter would be of no avail?

Does anybody wish to hazard a guess as to what the answer of the probability is that if they aimed at this building, say, shelter would not be of significance here?

(No response.)

Mr. STROPE. I will give you the answer. I worked it out some time ago. It works out to 4 chances in 100. In other words, 96 percent of the time, probabilitywise, speaking in probabilities, this building would not be in the region where shelter would be of no avail.

Mr. ROBACK. Mr. Strope, have you seen this study [indicating]? Are you familiar with this study?

Mr. STROPE. I have read the first part of it. I have a copy.

Mr. ROBACK. In reading this, in effect, doesn't that make this type of assumption, that there would not be any point in planning a shelter in this building?

Mr. STROPE. That is true, and I will discuss this a little later, not particularly that one, because it is no better or no worse than a great many.

By the very definition of circular probable error, this is a 50–50 chance, if the aiming point is this building, that the burst would be at least 5 miles away. Therefore, the reasonable probability would be that tactical defense measures even at the aiming point are important and will yield a return.

I think this is important aside from the point I am trying to make, in that if we start anything that we plan to do, such as a shelter system, nationwide, or road building, or whatever, it is going to take time. In fact, if we start tomorrow, there might not be enough time before the intercontinental missile is with us. And under these circumstances, it might be important to recognize that if you have the proper defense system—I am just using numbers here—they are actually a little better than that—any person in Los Angeles—and there were some remarks I believe this morning about the high risk of staying here—has 96 chances in 100 of surviving if he has the proper system, and I regard this as a pretty good chance.

As the situation stands right today, the chances are not great. The situation is grim, so to speak. But the effectiveness is there, and that is what I would like to go into at this moment.

Before——

Mr. ROBACK. Before you proceed, do I understand your testimony to mean that on the basis of this probable error that you are discussing, the rationale of a shelter program cannot have, as an assumption, a specific, designated target?

Mr. STROPE. I would like to answer that a little later. But I will answer it partially right now, that basically a completely target-oriented shelter system would be where the people are, that every time you deviate in terms of what you think might happen, it should first of all be regarded with suspicion and only accepted after you have carefully analayzed the cost if you are wrong.

If you have done this and found that the cost is not great compared to what you might save by adopting this procedure, perhaps it is correct. I would not want to say the optimum passive defense system will never have any weapon-oriented characteristics to it. But every one of those should have been subjected to a very close scrutiny before it as allowed into the plan.

I will go back to that in just a moment.

But now we have talked about this type of planning and how you can draw conclusions about certain things that actually the probability of its occurring is very low, and this very often happens.

Now, we feel——

Mr. HOLIFIELD. Now is this tied to the projected capabilities of accuracy of the intercontinental weapon only?

Mr. STROPE. It is true of any weapon delivery to a greater or less extent.

Mr. HOLIFIELD. It would also be true, possibly to a lesser extent or maybe just as great, in an intercontinental bomber attack?

Mr. STROPE. I think we would have to go into classified information to make any statement about it. I think the fact that delivery accuracies—I would like to point this out, that first of all you have to decide what the enemy thinks is important to hit, and second, he has a certain error in actually locating the aiming point. Then on top of this he has this thing that we have been talking about, merely the error in his delivery system once he has aimed at something. And it is only one part of all the errors that go into where the bomb is going to land.

And perhaps the other one, like what his objectives are in delivering the weapon, may override even the circular probable error.

I think, though, that if I show the alternative, or one of the alternatives, it might become clear as to why we regard this type of approach as an inadequate one, principally because it will only work under the conditions stated, when the conditions stated occur, and too often the probability that the stated condition will occur is too low to make it a useful system.

Now, in general, it is always better when you want to decide what countermeasures to undertake in a target area—it is invariably best to resort to a target-oriented approach, which is the opposite of this sort of thing.

Now, a good example of this is the so-called weak-link analysis, the concept of which is very simple, and in order to make this sound real, I am going to have to paraphrase the type of work we are doing for the military rather than a civil defense problem. I think you can see the direct application.

Suppose it is divided in a study of the target area that the ship repair functions of a certain naval shipyard are of vital concern in any future war, and that the principal reason for this concern is the availability of the installations' drydocks.

Let us suppose—and these numbers have no direct relation to reality—let us suppose that these drydocks can be expected to survive 50 pounds per square inch blast pressure, and that little can be done to make them less vulnerable. Of course, that is, as you know, a very hard target.

Now, regardless of any guesses about weapon yield, or ground zero, the 50 per square inch condition sets the first limitation on the defense effort.

The next step would be to look at all the other facilities that are essential to the functioning of the drydocks, and these could be the caissons, the pumps, power, cranes, shops, personnel, et cetera. And you look at these from the viewpoint of providing protection from all pertinent effects, not just blast: blast, thermal, fallout, et cetera, at the same distance from any detonation.

This actually ends up as a worse case analysis than where you look for that particular type of detonation which would require you to have the best defense in line with this 50 p. s.i. situation.

If, for example, it turns out that the drydocks are useless without power and all power comes from a nearby plant that will be demolished at 5 p. s. i., or to quote a different example, perhaps, burned to the ground at 10 calories per square centimeter, or whatever, then it is useless to try to provide greater protection to any other necessary component unless an adequate power supply is made available.

Now, in planning of this nature, it should be recognized that the essential facilities are, like chains, as vulnerable as their weakest link.

In practically no case would it be profitable—this is where this question of pouring the money down the rathole comes in—in practically no case would it be profitable to decrease the vulnerability of any component as long as a weaker component were not adequately protected.

Conversely, the full potential of an essential facility, in this case the shipyard with its drydocks, would never be realized so long as certain components that were essential to the work were not brought up to the same level of protection as the component that would survive at the closest distance to the burst.

Now, if you make a weak-link analysis, it usually turns out that protection of the work force against the effects of fallout is the weakest link in passive defense right now. It can occur under conditions of practically any target, in fact, well beyond the conditions where the physical plant will be affected in any way whatsoever.

Now, this concept of weak-link analysis, which is one of the type which is target oriented and does not concern itself with assumptions as to where the burst is going to be, and so forth, and which aims at a balanced protective system, ultimately so that it is as good as the strongest component, or if you do not have the wherewithal to do that well, at least brings everything up on an equal basis so that you are not mistakenly improving something when, so far as the overall result, you have really not made any improvement—we can apply this concept not only to a particular plant or installation, but also to a whole target area and ultimately to the whole Nation, in terms of the weak-link analysis in deciding where the effort should go.

The ones that are going to fail first and that we regard as essential should be the ones that should be worked on first.

Mr. ROBACK. And does it not follow that if you have a program which is geared to a number of alternatives, as for example, evacuation versus shelter, you are indulging in that kind of partial analysis of the problem, you might say?

Mr. STROPE. This is not as easy a question to answer as I would like it to be. I am going to answer it in the next few minutes, but I think I have to start and work into it.

Mr. ROBACK. Surely.

Mr. STROPE. I would like to point out that when I used the word "protection" in this discussion of the weak-link analysis, I was using it rather loosely, because the concept applies not only to protective construction, to build up elements so that they can resist blast, but also to the provision of alternate sources of provision for adequate means of repair and reclamation of the facility, so that I was oversimplifying the problem slightly in that regard.

The actual optimum procedure, the combination of protective construction, shelters, etc., is dependent usually on a careful study of the particular target involved.

What we have been able to say, in order that this does not just dissolve into nothing, is that, regardless of the target, you will find that the survival problem will always be based on shelters, and that the ability to rapidly recover your area will always be based principally on reclamation. The exact blend of the other measures is something that must be fitted to the target.

But these will always occur, and you cannot very well go wrong there.

Mr. HOLIFIELD. Reclamation will depend upon people that are left to do the job, will it not?

Mr. STROPE. Yes.

Mr. HOLIFIELD. And supplies.

Mr. STROPE. And the radiation exposure they have already received in their shelter.

This is why the statement is in the basic statement presented by Captain Hinners, that you cannot make a shelter for bare survival, because you automatically exclude this possibility when people are now at the casualty level. And therefore, you must very carefully design your shelter program so that it provides you with the situation in which this is feasible and cheap.

Ideally, you would like to design the system so that you get the whole job done at the cheapest possible cost. And this may mean very good shelters, more than if your only problem was survival that you would necessarily go in for.

Mr. ROBACK. In other words, shelter has an instrumental value in the total system, and is not to be considered just as a bare cover or protection from the blast?

Mr. STROPE. When you come down to the details of selecting what it should look like and what performance criteria you are going to place on it, it is very poor to decide that the only purpose you have in mind is survival.

You will end up then 3 days after the burst with everybody surviving in the shelters, and you have reached a dead end. You have no place to go.

Mr. HOLIFIELD. Would it be pertinent at this point to read "Central countermeasure in the emergency phase," section 3.4.1, into the record?

Mr. STROPE. That is entirely up to you, sir.

Mr. HOLIFIELD. Mr. Balwan, will you please read this into the record?

Mr. BALWAN (reading):

The central countermeasure in the emergency phase of radiological defense is believed to be adequate shelter. The relationship of countermeasures in an emergency phase is shown in figure 1 of this manual. The feasible effectiveness of shelter in reducing casualties is very high. Shelter is effective against all effects of atomic attack. Relatively simple underground shelters permitted survival near ground zero at Hiroshima. For surface and subsurface detonations on land, the violent movement of earth in the crater region limits the effectiveness of shelters. This region coincides roughly with the edge of the crater lip. Of course, in theory it is always possible to dig deep enough to achieve survival even in the crater region, but in most cases this goes beyond the defense capability. In general, the region of effectiveness of shelter extends inward to the crater level. When compared with the region of casualty production without shelter, this effectiveness is very high. If one can by means of shelter reduce casualties from high air bursts to zero and confine casualty production for other bursts to within the crater and its lip, one has blunted the antipersonnel capabilities of even the high-yield weapons. Shelter is applicable to practically all land targets and also to ships and aircraft. The practical limits of shelter effectiveness on ships and aircraft are linked with the survival of the craft, although weight limitations on aircraft may further limit the effectiveness. Most major naval ships contain areas that will permit survival up to the time when ships would be sinking. Many personnel can survive even after abandoning ship.

One additional limitation to the potential effectiveness of shelter is the need for warning. This need can be minimized by the proper location of shelters near or at the normal local of personnel. Again, in theory, the need for warning can be eliminated by making the normal location a shelter. This is a natural trend in tactical targets such as ships or gun or missile-launching placements, minimizing the need for launching is achieved by protecting the operating area or by providing for remote operations. These solutions are less practicable in nontactical targets, although the placing of vital industries and similar operations underground has occurred.

An outstanding example of underground shelter is Sweden, a nation that has recognized the essential nature of shelter and has proceeded to implement this solution. Not only has Sweden undertaken to provide adequate shelter for its urban populations, but also it has placed underground full industries, ship-operating bases, and repair facilities. Stockholm's new subway has specially designed shelters as shown in figure 2 of this manual.

The Swedish Air Force has at its disposal an impressive number of underground air-defense centers and airplane hangars. Planes start their takeoffs from underground locations. It is believed that underground installations costing $100 million are now in use in Sweden.

Mr. HOLIFIELD. I felt that that part of your study was pertinent there.

Mr. STROPE. I will carry it on right at that point, then, because I would like to say a few things about the most important countermeasures.

We have singled out shelter as the key countermeasure in the survival or emergency phase. A shelter by its nature is a target-oriented countermeasure, and its feasible effectiveness as mentioned in this excerpt is very high.

It appears that very good shelters can protect the occupants even at ground zero for an air burst and up to within 2 or 4 crater radii for a surface detonation.

Now, for a 10-megaton weapon, this means to within 1 or 2 miles of ground zero.

In Dr. Libby's presentation back in January, he presented a damage table for various yield weapons. I have taken the liberty of using this, and while it does not fit exactly what I am going to say, I think it is close enough.

If we take the extent of severe fire damage and moderate blast damage to homes, which is one of the lines in his table, as the region of casualties without shelter, this is 15 miles for a 10-megaton weapon, according to his data.

Mr. HOLIFIELD. Now, this, to give emphasis to it, is in effect a radius of 15 miles from point zero, wherever that may be, that you are speaking of?

Mr. STROPE. And this is 700, roughly, square miles.

Now, I would like to point out, before I go further, that as a surface burst, this area of casualty production from the immediate effects, namely, blast, thermal, and prompt radiation, 700 square miles, is about one-tenth of the total region of casualty production, there being on the order of 7,000 square miles for the fallout.

Mr. HOLIFIELD. But if there is no shelter within the 15-mile radius, it is reasonable to assume that there would be almost 100 percent casualties?

Mr. STROPE. There will be a dropoff. I am making these numbers comparable. Fifteen miles is a reasonable number to take here, in which there are 700 square miles in that region.

Now, if we consider the performance of shelters, we find that a system of adequate shelters would reduce this particular region to of the order of 3 to 12 square miles, depending on whether you took 1 mile or 2 miles, 2 crater radii or 4 crater radii, and the evidence does not permit us to pin it down any more.

Nevertheless, it is obvious that the effect of shelters is to reduce the area in which casualties would otherwise occur to about 1 percent of what it would have been for just the immediate effects, and in terms of the large regions, it is on the order of a tenth of 1 percent.

EXHIBIT 3

RADIOLOGICAL DEFENSE MEASURES AS A COUNTERMEASURE SYSTEM

Research and Development Technical Report USNRDL-TR-74, NS083001, February 15, 1956, by W. E. Strope

General, Technical Objective AW-5c

Military Evaluations Group

W. E. Strope, Head

Scientific Director, P. C. Tompkins

Commanding Officer and Director, Capt. R. A. Hinners, United States Navy

UNITED STATES NAVAL RADIOLOGICAL DEFENSE LABORATORY

SAN FRANCISCO, CALIF.

ABSTRACT

The importance of considering radiological defense measures as an interrelated system rather than as a collection of individual measures is emphasized. In discussing the radiological defense system, the defense problem is divided into three time phases: Emergency, operational recovery, and final recovery. The objectives and measures of effectiveness in each phase are discussed. Countermeasures are classified as to type. The concept of a central countermeasure type in each phase is introduced. Central countermeasures are selected and their interactions are discussed. It is concluded that failure to recognize the interactions between countermeasures is resulting in development of countermeasures on incompatible grounds.

SUMMARY

THE PROBLEM

Historically, radiological-defenses measures have been developed individually to meet specific problems arising from contaminating atomic attack. These countermeasures must be integrated as a system if an effective defense is to be achieved. The purpose of the study is to describe an integrated system and to point out interrelations that are important to performance specifications for countermeasures.

FINDINGS

Radiological defense is an important part of passive defense. The overall objective of passive defense is to minimize the effects of attack on operations. Three time phases are apparent: Emergency phase, operational recovery phase, final recovery phase. The objectives in each phase are respectively. Survival, early recovery of essential functions, ultimate recovery of normal functions. In everyday language, these objectives on a national scale are survive, stay in the war, and win the peace.

The large number of possible countermeasures fall into a limited number of countermeasure types. These types are rated qualitatively on feasible effectiveness and range of application. The outstanding countermeasure type in each phase is proposed as the central countermeasure for the phase. These are: For the emergency phase, shelter; for operational recovery, reclamation; for final recovery, indeterminate at present. The system hinges on the central countermeasures, the other important countermeasure types being regarded as peripheral to the central countermeasures.

The importance of interactions of countermeasures stems from the fact that personnel exposure to nuclear radiation is limited if casualties or other unwanted effects are to be avoided. The limiting exposure must be rationed over all three phases of the system. Thus, shelters cannot be designed simply for survival. If such is done, the subsequent phases become very costly or impracticable over large areas of the target. Shelter specifications must provide for more than bare survival; how much more depends on the nature and effectiveness of the remainder of the system. System implications are therefore an important consideration in specifying countermeasure performance.

Administrative Information

This is part of a general evaluation of countermeasures being studied under Bureau of Ships Project No. NS083001, Technical Objective AW-5c.

Contents

ILLUSTRATIONS

SECTION 1. INTRODUCTION

1.1 Purpose

Historically, radiological defense measures have been developed individually to meet specific problems which would arise from contaiminating atomic attack. To a large extent, this process has been inevitable, since both knowledge and understanding of the defensive aspects of atomic warfare have been acquired on a piecemeal basis through weapons tests, laboratory experiments, and operational analyses. If an effective and efficient defense is to be achieved, however, it is extremely important to approach radiological defense as though it were a system of interrelated countermeasures. The purpose of this report is to summarize the radiological defense system as it appears at this time and to point out the interrelations that are not being sufficiently accounted for in much of the present defense effort.

1.2 Scope

Radiological defense is a part of passive defense. Passive defense consists of measures taken to reduce the probability of and to minimize the effects of damage caused by hostile action, without employing active weapons or initiating offensive action.[1] In other words, passive defense starts with the assumption that the weapon will be delivered to the target. Its purpose is to minimize the effects of the attack upon our operations. As a result of the development of larger nuclear weapons and also of an increased knowledge of the offensive capabilities embodied in various ways of using nuclear weapons, the contaminating atomic attack has become increasingly probable. Therefore, radiological defense has become an increasingly important part of passive defense. This report will be applicable to the general problem of passive defense against atomic attack, to the extent that contaminating atomic attack becomes the preferred way of using the nuclear weapon.

SECTION 2. CHARACTERISTICS OF RADIOLOGICAL DEFENSE

2.1 Phasing of the defense problem

The possible range of atomic-attack situations that may occur in a future war is so large that meaningful statements of a completely general nature are difficult to make. Laurino[2] has pointed out that specific statements about countermeasures require careful definition of the situation of interest, and has proposed to achieve this definition by consideration of three properties of the situation: the nature of the attack, the nature of the target, the operational period of interest. The more specific a statement must be, the more detailed the description of these three properties must be.

For an appreciation of radiological defense as a general countermeasure system, it is important and productive to differentiate between the operational periods of interest; that is, to time phase the radiological defense problem. The reason that such phasing is useful is that the local objectives of these phases are quite different, and therefore the countermeasures involved in each phase and their measures of effectiveness are distinct. Radiological defense appears to fall naturally into three time phases[1 2 3] which may be designated as emergency phase, operational recovery phase, and final recovery phase. The time periods involved cannot be rigidly defined and in some situations the phases may not be sharply differentiated. In general, however, the emergency phase begins upon warning of attack, if such occurs, and lasts for several days to a week after attack for nontactical targets. Where tactical targets are involved, the emergency phase may last only minutes or hours after attack. The operational recovery phase follows the emergency phase and may last for months or years, perhaps for the duration of hostilities. The final recovery phase follows the operational recovery phase and persists for an indefinite period. Because it is desired to treat radiological defense as a general system applicable to all contaminating attacks and to all targets, the detailed description of these characteristics will be avoided. However, specific examples will be introduced with emphasis on defense of the continental United States.

2.2 Phase objectives

The objective of the emergency phase is survival. Since nuclear radiation is an antipersonnel effect, the objective of this phase in radiological defense is simply the survival of personnel. In the larger framework of passive defense, it extends to survival of facilities. Footnote 1 defines emergency measures as actions "taken to keep loss of life and property to a minimum." Similar expressions of objective occur in civil-defense literature.

The objective of the operational recovery phase is to regain the military usefulness of the target as soon as possible. Footnote 1 refers to operational recovery measures as "steps taken to restore the essential utility of an activity." Reference 4 also regards this phase as the process of restoring essential functions. When one recalls the overall objective of passive defense—to minimize the effects of the attack on operations—it can be seen that the local objective of the emergency phase is not sufficient. In addition to survival, passive defense must minimise the interruption of essential war functions caused by the attack.

It is due to an accident of history that consideration of the radiological defense problem began with the operational recovery phase. Contaminating atomic attacks have been observed only at weapons tests. Personnel are carefully excluded from the target area during the test detonations. Upon reentry, test personnel have encountered large contaminated regions that restrict and deny their operations under the rigid safety precautions prevailing at the test site. Later analysis of the test results reveals that a somewhat smaller but still important region would deny operations even under wartime conditions. Thus, the denial aspect of the contaminating event or fallout has been clearly evident. Early efforts in radiological defense were concerned with this problem, beginning with attempts to recover the usefulness of the target ships contaminated at Operations Crossroads. On the other hand, experience with the noncontaminating or high air-burst attack began at Hiroshima and Nagasaki. These were occupied targets and the attacks caused great numbers of casualties. For a long time, the problems of survival under atomic attack were associated rather closely with the high air burst. Although small groups concerned with radiological defense have attempted periodically to question this concept, it has been comparatively recently that the problem of survival under contaminating attack has been recognized in its true magnitude. The unintentional exposure of a considerable group of people to fallout from a detonation in Operation Castle was instrumental in bringing about this recognition.

The objective of the final recovery phase is to restore the normal or preattack situation in the target. This phase of radiological defense has not received much attention until recently. It has been recognized as a necessary long-term rehabilitation effort following a war, but its connection with military problems has seemed remote. With the production of significant numbers of superweapons, the prospect has arisen that a full-scale nuclear war may result in contamination of a large part of the continental U. S. In this event, many features of our society, such as normal agriculture, may be in peril. This problem has military significance in that military operations are ultimately conducted to achieve the national war aim of preserving our way of life. If we win a nuclear war at the sacrifice of our way of life, the national war aim is not achieved. Consequently, the need for incorporating this objective in the countermeasure system to achieve the overall objective of passive defense has become increasingly real. In summary, the overall objective of radiological defense—to minimize the effects of nuclear radiations on operations—appears to involve the successive objectives of survival, rapid recovery of essential functions, and ultimate recovery of normal functions.

2.3 *Measures of effectiveness*

In order to compare countermeasures and to evaluate a countermeasure system, it is necessary to choose a quantitative measure of the effectiveness of the countermeasures or system in achieving the objective. Having defined the objectives of the three phases of radiological defense, it is of interest to note the measures of effectiveness that suggest themselves in each phase.

2.3.1 *Measure of effectiveness in emergency phase*

Since the objective of the emergency phase is survival, the appropriate measure of effectiveness of countermeasures in this phase appears to be the number or proportion of survivors. The optimum countermeasure system in this phase, then, is one that maximizes survivors or, alternatively, one that minimizes casualties. Optimality also contains the idea of cost; that is, the balancing of effectiveness against cost. Hence, one might compare countermeasures or countermeasure systems in the emergency phase on the basis of reduction of casualties for comparable cost or on the basis of least cost for an acceptable casualty level.

In attempting a comparison of this type, it is, of course, important to define the term "casualty." Used as above as the pure opposite of survivor, casualty must be defined as a lethality. As pointed out previously, a specific evaluation requires a detailed knowledge of the situation. In many situations, a sick person cannot be considered a survivor for practical purposes. A casualty might then be defined as a "combat noneffective" or some similar term. Again, time may play a significant role, as in most tactical situations, so that the casualty may be a "noneffective within 2 hours." In general, however, reduction of casualties will be the preferred criterion, defined in terms consistent with the situation.

2.3.2 Measure of effectiveness in operational recovery phase

The objective in the operational recovery phase leads one to a consideration of the delay time or denial time caused by the attack before essential functions are once more operable. To minimize the effects of the attack on operations, it is desired to minimize this delay in resumption of operations. The time after attack at which essential functions are regained is called "mission entry time."[3] Mission entry time thus becomes the general measure of effectiveness of countermeasures in the operational recovery phase. We can compare countermeasure systems in this phase on the basis of earliest mission entry time for comparable cost or, alternatively, on the basis of least cost for an acceptable mission entry time. It is worth while to point out that the criterion of acceptability will vary with the nature of the target. For example, delays of a week or so might be acceptable in nontactical targets while the acceptable delay in tactical targets may be a matter of minutes.

There are other possible measures of effectiveness in the operational recovery phase but these imply a different objective for the phase. Use of the casualty reduction criterion requires that the objective be the conduct of operations at a given time and for a stated period with a minimum of casualties. Stay time may also be used as a measure if the objective is rephrased to involve the recovery of operations at a stated time for as long as possible. However, stay time and acceptable casualty level usually being fixed by the mission of the target, it has been found that emphasis in the operational recovery phase is on minimizing the denial period.

2.3.3 Measure of effectiveness in final recovery phase

The understanding of the final recovery phase at the present time is considerably more vague than the understanding of the first two phases because of the small amount of information available. Certainly, the major characteristic of the objective is "normality." It is desired to minimize over a long period the deviation from normal operations. In radiological defense, one must consider the long-term effects of radiation on humans—such as incidence of cancer, changes in the blood, shortening of the life span, and even genetic effects on future generations. These long-term effects must be minimized, and inevitably acceptable deviations from the normal must be established. Then, countermeasures for this phase can be evaluated.

SECTION 3. CHARACTERISTICS OF COUNTERMEASURES

3.1 Countermeasure types

When we survey the countermeasures available or proposed for use in atomic defense, we are faced with an astonishing collection of possibilities. This large number of individual countermeasures fall into a much smaller number of countermeasure types—dispersal, damage control actions, shelter, reclamation, and the like. Within each type are individual actions, each with its characteristic performance and cost. In developing a countermeasure system, it is fruitful to look at the general potential of the countermeasure types. Some are inherently more valuable than others in achieving the objective.

3.2 Potential value of countermeasure types

The potential value of a countermeasure type in passive defense appears in two general characteristics. The first of these is the feasible effectiveness of the types. In practical application, all countermeasures have limitations. Countermeasures that completely achieve the operational objective and thus reduce the effectiveness of attack to zero appear to exist only in theory. In some cases this is because the costs entailed are beyond the defense capabilities. For example, complete protection or shelter of all facilities and personnel in a large target may be a good theoretical solution but may entail costs both direct and indirect that are clearly beyond the practical capability. In other cases, there are real limitations in the attack situation regardless of the effort available. A most obvious example is rescue and medical aid after attack. Since an attack will cause a large number of casualties almost immediately, the feasible effectiveness of medical aid is limited to that fraction of the survivors whose fate could be altered by the existence of adequate medical aid.

The second characteristic is that of range of application. It should be recalled that passive defense situations can be defined in terms of three properties: The nature of the attack, the nature of the target, the operational period of interest. In time phasing the defense problem, we have accounted only for the latter property. In each phase, we must look at countermeasure types with regard to their applicability in terms of attacks and targets. A universal countermeasure is one that maintains its effectiveness over the complete range of attacks and in all targets. Again, in practice, the universal countermeasure does not seem to exist. But some countermeasure types approach the ideal very closely.

3.3 Central and peripheral countermeasures

In developing a countermeasure system, it appears reasonable to place emphasis on the countermeasure types of greatest potential, as expressed in terms of feasible effectiveness and range of application. Any other approach would result in a specific grouping of countermeasures for each special situation. Not only would there be a different countermeasure system in each target, but also perhaps several systems to cover the range of possible attacks. This is manifestly inefficient. Some "tailoring" of a general countermeasures system must undoubtedly occur in each target because of differing conditions or requirements; but if the defense is to be well founded, deviations from a general system should be done only for good and sufficient reasons. Furthermore, it would be found generally that the tailoring process will occur in the choice of specific actions within a countermeasure type, rather than in the choice of a countermeasure type.

When countermeasure types are compared with respect to the objective of each radiological defense phase, it may be found that one type stands out from the rest in potential value. That is, it possesses characteristics of feasible effectiveness and range of application that distinguish it from other countermeasure types. If such is the case, this type of countermeasure should form the keystone of the countermeasure system. We may call such a countermeasure type the central countermeasure. It so happens that the central countermeasure can be determined in each phase of radiological defense.

Once the central countermeasure is selected, the remaining countermeasure types may be regarded as peripheral countermeasures. Peripheral countermeasures are found to possess one or more of the following characteristics:

(*a*) The feasible effectiveness of the countermeasure type is relatively low.

(*b*) The range of application is limited to a segment of possible defense situations.

(*c*) The effectiveness of the countermeasure is highly dependent upon the existence of the central countermeasure as a prerequisite.

When a countermeasure type is labeled a peripheral countermeasure, it is not intended to convey the impression that such countermeasures are useless and should not be undertaken. Any effective countermeasure system will include a number of peripheral countermeasures in addition to the central countermeasure. But a peripheral countermeasure does not possess the characteristics necessary to form the hub or keystone of the system.

The term "central countermeasure" has been chosen to convey the notion that such a countermeasure type represents the core, heart, or essence of defense in the particular time phase of radiological defense. Peripheral countermeasures, however important, act in support of and derive support from the central countermeasure. In a sense they revolve about the existence of the central countermeasure. In the following paragraphs, the central coutermeasures are discussed. An exhaustive treatment of the potential value of the various countermeasure types will not be attempted. In fact, the general statements made must be tested in future analyses of a more specific nature and the system described here supported or modified.

3.4 Central countermeasure in the emergency phase

3.4.1 Selection of the central countermeasure

The central countermeasure in the emergency phase of radiological defense is believed to be adequate shelter. The relationship of countermeasures in the emergency phase is shown in figure 1. The feasible effectiveness of shelter in reducing casualties is very high. Shelter is effective against all effects of atomic attack. Relatively simple underground shelters permitted survival near ground zero at Hiroshima. For surface and subsurface detonations on land, the violent movement of earth in the crater region limits the effectiveness of shelters. This region coincides roughly with the edge of the crater lip. Of course, in theory

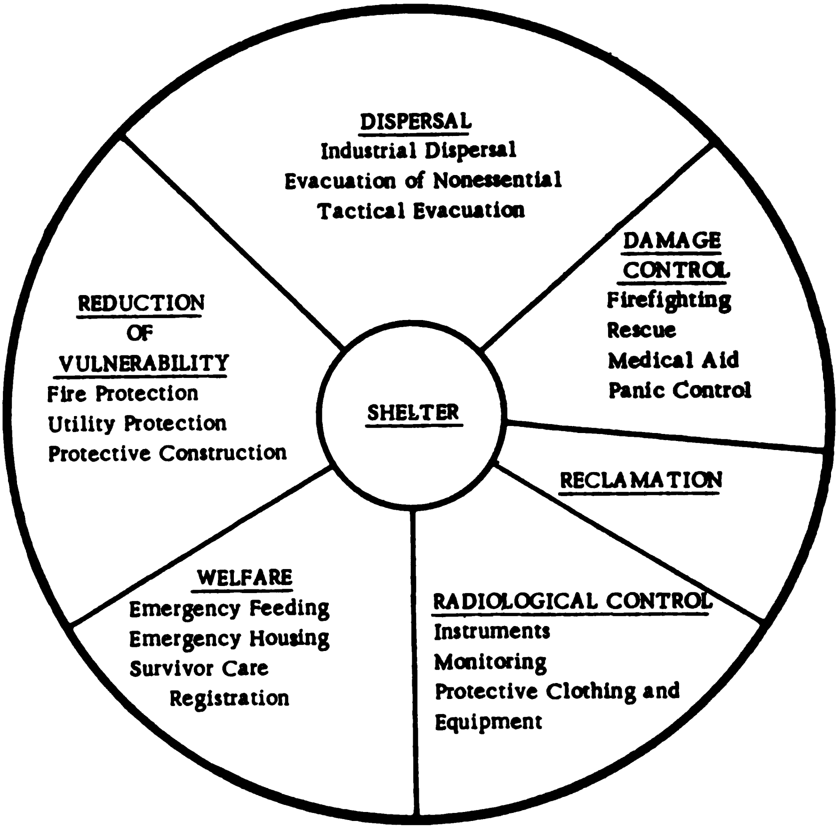


Fig. 1 Countermeasure System in the Emergency Phase

it is always possible to dig deep enough to achieve survival even in the crater region but in most practical cases this goes beyond the defense capability. In general, the region of effectiveness of shelter extends inward to the crater lip. When compared with the region of casualty production without shelter, this effectiveness is very high. If one can, by means of shelter, reduce casualties from high air bursts to zero and confine casualty production for other bursts to within the crater and its lip, one has blunted the major antipersonnel capability of even the very high-yield weapons. Shelter is applicable to practically all land targets, and also to ships and aircraft. The practical limits of shelter effectiveness on ships and aircraft are linked with the survival of the craft, although weight limitations on aircraft may further limit the effectiveness. Most major naval ships contain areas that would permit survival up to the time when the ships would be sinking; many personnel can survive even after abandoning ship.

One additional limitation on the potential effectiveness of shelter is the need for warning. This need can be minimized by the proper location of shelters near or at the normal location of personnel. Again, in theory, the need for warning can be eliminated by making the normal location a shelter. This is a natural trend in tactical targets, such as ships, or gun, or missile-launching emplacements, where minimizing the need for warning is achieved by protecting the operating area or by providing for remote operation. These solutions are less practicable in nontactical targets, although the placing of vital industries and similar operations underground has occurred.

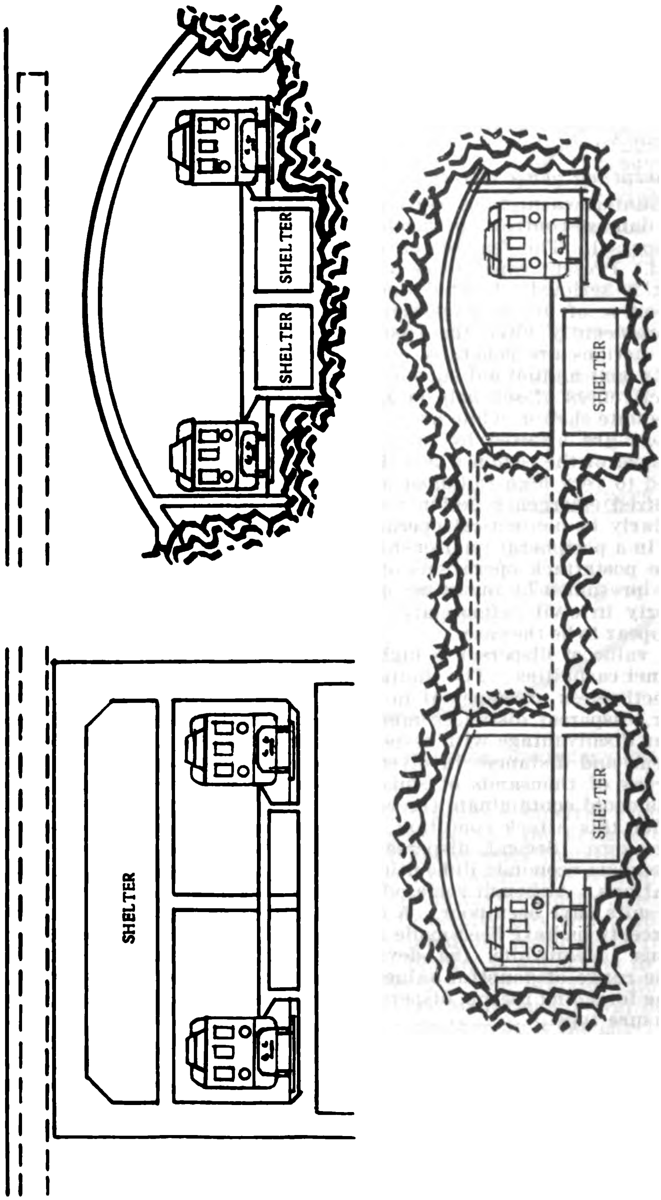
An outstanding example of underground shelter is in Sweden, a nation that has recognized the central nature of shelter and has proceeded to implement this solution. Not only has Sweden undertaken to provide adequate shelter for its urban populations, but also it has placed underground whole industries, ship-operating bases, and repair facilities. Stockholm's new subway has specially designed shelters as shown in figure 2. The Swedish Air Force has at its disposal an impressive number of underground air-defense centers and airplane hangars. Planes start their takeoffs from underground locations. It is believed that underground installations costing $100 million are now in use in Sweden.[6]

3.4.2 Other emergency phase countermeasures

Peripheral countermeasures of considerable importance in the emergency phase include damage-control operations after attack, reduction of vulnerability, and dispersal. The feasible effectiveness of damage-control actions is not well defined. Present capabilities do not appear to have a high potential. For example, it is seriously doubted that conventional fire-fighting techniques can alter the course of fire damage significantly. The ability of the medical facilities to significantly alter the casualty level has also been questioned. Damage-control actions are generally divided into self-help on the part of the target population and mutual-aid support from organizations outside the target area. The effectiveness of self-help measures is obviously dependent upon the existence of adequate shelter, while mutual-aid efforts become much less effective when large areas are affected by high-yield weapons. Under contaminating atomic attack, most of the region where damage-control actions may be effective will be subjected to very high radiological hazards from fallout. The practical utility of organized emergency action may become negligible under these conditions, particularly in nontactical operations. These limitations clearly place damage control in a peripheral relationship to adequate shelter. It is important to note that the postattack operations of damage control, radiological control, and welfare are presumed by many people to represent the heart of atomic defense, particularly in civil defense and passive defense of land installations. Such does not appear to be the case.

The potential value of dispersal is high, perhaps next to adequate shelter in reducing personnel casualties. The limitations of dispersal are twofold. First, the feasible effectiveness of dispersal in sensitive to weapon yield. As larger weapons appear, dispersal distances must increase to be effective. Dispersal is at a particular disadvantage with respect to the contaminating event because of the large areas and distances involved. Superweapons can produce fallout casualties in areas of thousands of square miles. A relatively small number of these weapons could contaminate the whole United States to casualty-producing levels. Under this attack condition, the value of dispersal in radiological defense drops to zero. Second, dispersal on land targets is costly and slow. There are tremendous economic difficulties involved in the relocation of industries and populations. Although some official encouragement has been given to dispersal, the results have been poor. A dispersal distance of 10 miles has been set, but many exceptions have been made in the granting of industry permits for economic reasons. Meanwhile, the development of high-yield weapons has made the 10-mile range of doubtful value. Similar limitations exist in tactical targets. For the foregoing reason, dispersal appears to be a valuable but peripheral countermeasure type.

Because of the difficulties in achieving permanent dispersal, a special type of dispersal known as tactical evacuation is being studied by the Federal Civil Defense Administration. Tactical evacuation involves the dispersal of personnel upon warning to supposed safe areas in the outer reaches of the target. Tactical evacuation suffers not only from the limitations previously discussed but also from the fact that it is applicable to a very limited segment of atomic attack situations. It is practicable only in certain land targets and, even in such targets, requires a long warning period. It is not useful unless such warning exists. Although a warning period of several hours' duration may be achieved during the next few years, it is well recognized that the introduction of high-speed intercontinental ballistic missiles will soon reduce the achievable warning time



Three types of shelter. Upper left - over the train platform. Right - below the train platform.
Lower - under each platform for trains in opposite directions.

Fig. 2 Shelters in Stockholm Subway (Illustration adapted, courtesy of The American Swedish Monthly (Ref 5)).

to a matter of minutes. Therefore, tactical evacuation has only limited temporary value in the passive-defense system.[1] Nevertheless, a great deal of confusion has resulted from the attempts by some people to propose tactical evacuation as the central countermeasure—as a cheap substitute for adequate shelter. Regarded in its proper role as a useful peripheral countermeasure, tactical evacuation can be valuable in reducing casualties where it is practicable, but it should never be regarded as a substitute for shelter as the central countermeasure in the emergency phase.

3.5 Central countermeasure in the operational recovery phase

3.5.1 Selection of the central countermeasure

The central countermeasure for operational recovery appears to be reclamation.[2] Reclamation has essentially universal application to targets. Specific measures range from extremely simple techniques of modest effectiveness, such as plowing or fire hosing, to rapid and highly effective devices, such as the shipboard washdown countermeasure. The washdown system demonstrates the high feasible effectiveness possible in reclamation.

3.5.2 Other countermeasures in the operational recovery phase

Important peripheral countermeasures in the operational recovery phase of radiological defense are shielding and the adjustment of operating procedures.[3] In the broader area of atomic defense, repair of physically damaged facilities, replacement of facilities damaged beyond repair, and relocation of functions in undamaged areas are also important. The relationship of these countermeasure types is shown symbolically in figure 3.

In radiological defense, shielding is synonymous with shelter. While shelter is the central countermeasure in the emergency phase, its role in the operational-recovery phase appears, in most instances, to be peripheral. Unless the ultimate in shelter during the emergency phase has been achieved—that is, the placing of industry underground or other means of protecting the normal work area—shielding is applicable in operational recovery to limited situations where the work area is relatively small and the placement of heavy temporary shielding is acceptable. The limit on adjustment of operating procedures, such as work shifts and personnel rotation, is primarily one of cost. Large numbers of additional trained personnel are required to achieve significant improvements in mission entry time. Since trained manpower is at a premium in wartime, and particularly after atomic attack, adjustment of operating procedures is rarely a satisfactory solution to operational recovery. When used with the central countermeasure, these peripheral countermeasures can be very important in building an optimal countermeasure system, as shown in the planning sections of reference 3. The same holds for tactical targets, such as ships, where the taking of shelter in the emergency phase, coupled with the washdown reclamation measure and rotation of topside crews, results in a highly effective radiological-defense system.

In atomic defense, repair of damaged facilities is an important countermeasure. In the broadest sense, repair could be considered a part of reclamation. In contaminating atomic attack, damage to facilities occur, but the damaged region is also radiologically contaminated. Therefore, repair depends upon effective reclamation countermeasures, if early recovery is the objective. This dependence makes repair a peripheral countermeasure. Since the damaged region constitutes only a part of the contaminated region, operational recovery does not always entail repair of facilities.

3.6 Central countermeasure in the final recovery phase

As indicated before, the final recovery phase has not received much study until recently. As a result, the possible countermeasure types are not clearly understood. This makes a decision on the central countermeasure impossible at this time. Since the objective of this phase is to regain normal functions, many

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[1] Hon. Val Peterson, Federal Civil Defense Administration Chief, in a speech before the Helicopter Association of America in San Francisco on January 24, 1956, stated: "Today we can give warning of an attack in time for evacuation of the city, but when the guided missile is fully developed then it will be a case of 'take shelter where you can.'"

[2] Reclamation is used here to include not only the removal of radioactive contaminants from target surfaces by means of decontamination but also the burial or covering of the contaminant. In general, it includes all operations on the contaminants itself to reduce the radiation field. This is in acocrd with the usage in reference 3.

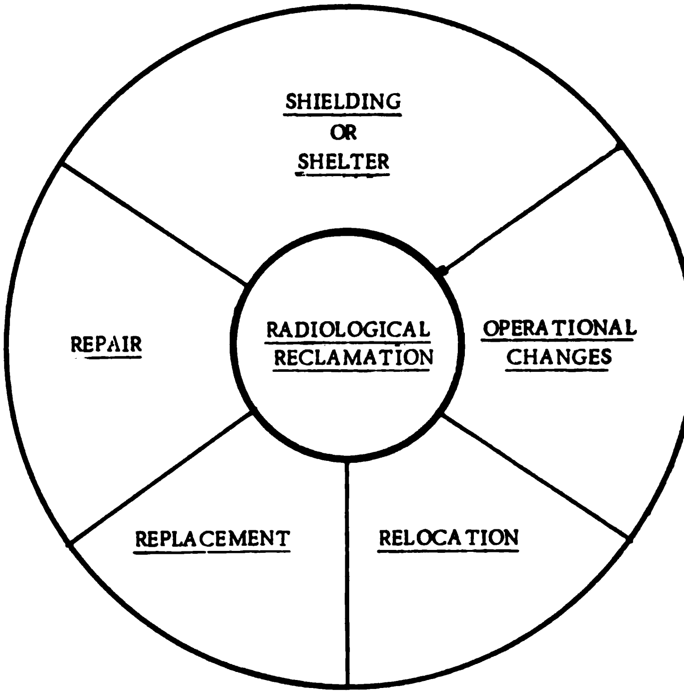

Fig. 3 Countermeasure System in the Operational Recovery Phase

countermeasures such as excluding people from contaminated areas do not appear useful. Shelter also appears to have limited value. Reclamation may be useful but the process of reducing contamination levels over large areas to very low amount appears to present great difficulties. There are some forms of exposure control, such as dilution or natural concentration, which may prove to have the central characteristics required in final recovery.

3.7 Summary of defense system by phases

To minimize the effects of contaminating nuclear attack on operations, we have seen that a time-phased process of survival, early recovery of essential functions, and ultimate recovery of normal functions will be required. In the first phase, primary dependence must be placed upon adequate shelter. Associated with this central countermeasure and its tacitly assumed existence will be a number of important peripheral countermeasures which include dispersal, reduction of vulnerability, and damage-control actions. In the second phase—the early recovery of essential functions—the central countermeasure will be reclamation of the vital area of the target, supported by the use of shielding and the adjustment of operating procedures. In the third or final phase, the ultimate recovery of normal functions will involve one or more forms of exposure control, supported by reclamation and other countermeasure types. An indication of this general system is shown in figure 4.

It is important to note that, in most cases, a given countermeasure type may have value in more than one phase of radiological defense or perhaps in all phases. This is particularly true of the central countermeasures. It must be emphasized, however, that the principal utility of a countermeasure type is associated with a single phase and its specific objective. For example, reclamation is the central countermeasure in the operation recovery phase; however, it is no more than a peripheral damage-control action in the emergency phase and, except in some tactical situations, is likely to be of marginal value in limiting casualties. Reclamation will also be of use in the final recovery phase, but the tremendous effort involved in the clearing of very large areas to extremely low radiation levels does not promise it a central status. In

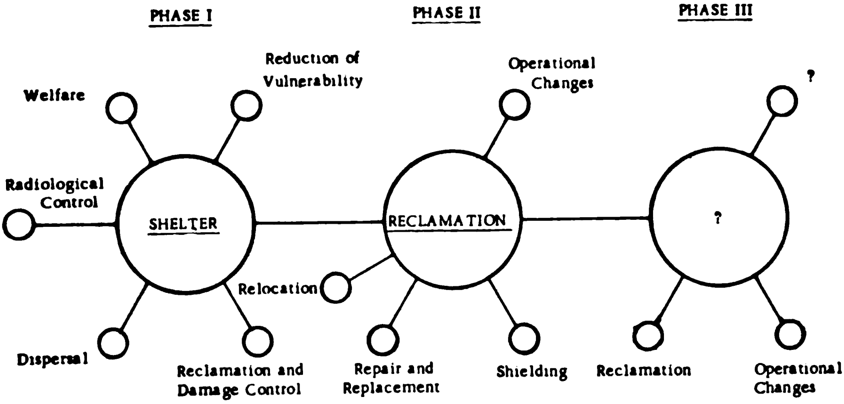

Fig. 4 General System of Radiological Defense

the same way, shelter is central in achieving survival but is considered to be more limited in early recovery of essential functions in most instances. Not being a part of normal operations, shelter has minor value in final recovery. Much confusion is caused in radiological defense by discussing a countermeasure in the wrong context; as in giving great weight to reclamation in damage-control operations in the emergency phase where such weight is not warranted.

SECTION 4. INTERACTIONS IN THE COUNTERMEASURE SYSTEM

The foregoing discussion of radiological countermeasures and their place in a radiological defense system contains nothing startling. The framework presented is of principal value as a starting point for the consideration of the interactions of the defense phases and the countermeasures of primary importance in each. The recognition of the existence of these interactions is an essential step in dealing with radiological defense as a coherent system rather than as an assemblage of individual countermeasures.

It should be recalled that nuclear radiation is of military importance because it is a casualty-producing agent. The dominant fact in radiological defense is that each person has a finite amount of radiation exposure he can sustain before he becomes a casualty. The absolute value of this exposure varies somewhat from individual to individual. Because of the ability of the human body to recover partially from radiation received over a period of time, the limiting exposure cannot be measured directly in roentgens or a similar unit. However, general agreement exists that exposure distributed over a period of time can be interpreted by means of one or more suitable recovery equations in terms of an equivalent short-term exposure. The concept of damage dose has also been proposed as a possible measure of effective biological exposure. The significance of the concept of a limiting exposure in the radiological defense system will be discussed in the following paragraphs.

4.1 Interactions of central countermeasures

Let us consider the specifications of countermeasures in the emergency phase. The central countermeasure is adequate shelter. The question of interest is: What is adequate shelter? If this problem is considered wholly within the emergency phase, the answer is relatively simple. The optimum shelter is the cheapest shelter that assures survival under atomic attack, survival being defined in appropriate terms. Over most of the region of interest in contaminating atomic attack, protection against fallout radiation will dominate the shelter requirements. If shelter specifications are based entirely upon the objective of survival, personnel in shelters at the end of the emergency phase will have survived, but a great number of persons will be at or near the casualty threshold. It is clear that our population will be in a trapped state; they will have survived the attack but they will lack the reserve of radiation exposure necessary to embark on the operational-recovery phase. If recovery is to occur, these people must be removed from the area, and operational recovery and operation of the essential target functions must be conducted with new personnel from an area that has not undergone attack. These actions may be very difficult to carry out, if not impossible, and it certainly does not represent an effective solution to radiological defense.

Again, let us look at the specification of countermeasures in the operational-recovery phase. The central countermeasure is reclamation. As shown in reference 3, reclamation measures are selected to achieve a satisfactory mission entry time for operation of essential functions. Radiation exposures of both recovery crews and mission personnel are usually kept below the casulty threshold. But, in general, little or no consideration is given to exposure history in the emergency phase. Reference 3 does suggest that 100 roentgens of the acceptable distributed dose be reserved for emergency-phase exposure, but no attempt is made to compute the probable exposures in existing or contemplated shelters. The tendency in development of operational-recovery phase measures is to assume that protection in the emergency phase has been perfect. Unfortunately, the development of emergency countermeasures has generally proceeded independently of any requirements for subsequent radiological exposure. Very often, therefore, it can be clearly seen that the development of radiological countermeasures is being pursued on completely incompatible grounds. The interaction between countermeasures is being ignored.

What is needed is a systems approach to radiological defense. Rather than consider shelters as a separate matter from decontamination, we must seek the cheapest countermeasure system that meets the requirements of both phases. Looked at this way, it appears that it may be cheaper to make our shelters more effective so that we can use relatively simple and available reclamation equipment such as the fire hose and scrub brush. Certainly, unless perfect solutions to operational and final recovery are found, shelters should not be designed for bare survival.

In like manner, the problems of final recovery must be faced. The closest approach to the final recovery problem is the present AEC peacetime permissible exposures, which are quite low. As low as they are, these exposure limits are based on exposure of a limited portion of the population over a long-term period starting with little or no previous exposure. If the countermeasure system satisfactorily achieves the objectives of the emergency and operational recovery phases but results in a large part of the population reaching the final recovery phase with a massive radiation-dose history, must not subsequent permissible exposures be even lower than the present peacetime regulations? Such requirements may make exposure control technologically infeasible. Information on these problems is sparse. However, it should be clear that the optimum countermeasure system must produce the cheapest and most feasible answer to all three phases, if the overall objective of radiological defense is to be met.

4.2 Other interactions

The foregoing discussion has tended to emphasize interactions following the chronological sequence. It has been pointed out, for example, that the capabilities of countermeasures in the emergency phase form the boundary condition for the feasibility of countermeasures in the operational recovery phase. If shelter criteria are based on bare survival, the operational recovery problem becomes virtually impossible. It should be clear that interactions exist in the opposite direction. If highly effective operational recovery measures exist, they may lessen the performance requirements in the emergency phase. The clearest example of this interaction lies in the shipboard washdown countermeasure. This measure not only achieves rapid operational recovery but has a significant effect on the requirements for shelter in the emergency phase. Part of this effect is because the washdown countermeasure, in order to achieve its effectiveness in operational recovery, must be operated during the emergency phase. Washdown therefore contributes directly to the protection of personnel. The existence of a highly effective reclamation measure in operational recovery also can exert an indirect effect on the countermeasure requirements in the emergency and final recovery phases as discussed in the following paragraph.

4.3 The problem of optimum allocation of exposure

The interactions that have been briefly reviewed in the foregoing paragraphs result primarily from the fact that people can undergo a limited exposure to nuclear radiation before unwanted biological effects result. Each countermeasure, no matter what its place is in the defense system, draws a certain amount from this limited account. If we spend heavily in one phase, we must conserve greatly in the others. The optimum defense system is the cheapest and most feasible set of countermeasures that does not overdraw the account. Therefore, an alternative way of looking at the radiological defense system is to regard it as a problem of optimum allocation of radiation exposure to the three phases. The operational requirements for countermeasure performance in each phase may be set by allocating a portion of the total desired exposure to each phase. This does not simplify the systems solution any, but it does emphasize the limiting parameter. It also brings to the attention the fact that the foregoing discussion is confined to a single experience with contaminating nuclear attack. If it is desired that the countermeasure system permit personnel to undergo two or more nuclear attacks, the allocation of exposure must be made accordingly and the requirements placed on countermeasures will increase.

Thus it appears that the measures of effectiveness indicated in paragraph 2.3 must be handled cautiously. They are useful only within the given phase. A simple measure of effectiveness for the total radiological defense system has not been elucidated as yet and may not exist. For this reason, the simple measures of effectiveness will continue to be used. An understanding of the larger system and careful attention to the boundary assumptions in each phase must be used to avoid serious pitfalls.

SECTION 5. CONCLUSIONS

From this preliminary attempt to view radiological defense measures as an integrated countermeasure system consisting of three basic time phases, and from consideration of the critical interactions of the whole system, it seems evident that radiological defense measures—and atomic-defense measures in general—are being developed individually rather than as an integrated system. As a consequence, these measures, while ostensibly capable of achieving a local objective, were very often based on assumptions so incompatible that it is difficult to see how the overall passive-defense objective can be achieved.

Most passive-defense concepts have been inherited from experience with conventional weapon attacks, such as high explosives and incendiary bombings. The use of the atomic bomb at Hiroshima and Nagasaki forced major changes in passive-defense thinking. The existence of weapons a thousand times more powerful than previous high explosives made dependence on self-help damage control unrealistic. Organization of area resources for mutual aid became extremely important. But emphasis was still placed on emergency phase measures. The later problems of operational and final recovery were concluded to be separate and distinct problems to be handled more routinely by other than passive-defense forces.

The advent of the superweapon was another thousandfold increase in the power of attack. The impact on passive-defense thinking has only recently begun to be felt. The tremendous radiological capability of superweapon contaminating attack has opened new vistas of weapons employment. In radiological defense, the conclusions are clear. We can no longer delay the integration of radiological defense measures into a consistent countermeasures system. The later phases of the problem will not take care of themselves or be taken care of by routine actions. The selection of countermeasures and the specification of countermeasure performance must be conditioned by the defense capabilities that precede and follow the particular measure as well as those that are more closely associated with it.

It is clear also that, as the attack capabilities increase, the defense must concentrate its limited resources on those central countermeasures that have the feasible effectiveness and range of application necessary to assure a consistent payoff in minimizing the effects of attack.

Approved by:

EUGENE P. COOPER,
Associate Scientific Director.

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EXHIBIT 4

PASSIVE DEFENSE PHILOSOPHY AND PRINCIPLES OF DAMAGE CONTROL IN ATOMIC ATTACK ON SHORE ESTABLISHMENTS

United States Naval Radiological Defense Laboratory Report, USNRDL-450, NS083-001, September 1, 1954, by W. E. Strope

Military Applications, Technical Objective AW-5c

Military Evaluations Group

W. E. Strope, Head

Scientific Director, P. C. Tompkins

Director, Capt. R. A. Hinners, United States Navy

UNITED STATES NAVAL RADIOLOGICAL DEFENSE LABORATORY

SAN FRANCISCO, CALIF.

ABSTRACT

This report presents a statement of passive-defense philosophy in atomic attack and of the principles of damage control after attack, with specific reference to the Navy's shore establishments. Since the radius of action of atomic and thermonuclear weapons is large compared with the dimensions of most shore establishments, a system of mutual aid among activities is mandatory. A dynamic and flexible plan of action after attack is presented which is believed to offer the best promise for effective damage control. The plan consists of a two-perimeter system based on a cellular defense organization, and is designed to be operable over a wide range of possible atomic attacks. It is urged that the plan be extended to include the sister services and civil defense.

The saving of lives and property is emphasized as the major objective of passive defense. To achieve this goal, attention is directed toward:

(*a*) Providing a system of mutually supporting passive-defense units capable of operating quickly and effectively in damage control.

(*b*) Providing a system to control and protect personnel under attack conditions. The importance of control of individual actions is stressed.

Emphasis is placed on the necessity for regarding the passive-defense organization as a cadre group requiring leadership training.

ADMINISTRATIVE INFORMATION

This work was assigned by Bureau of Ships letter ND/PRNC/P11 (588) serial 588-269, of June 16, 1953, and was performed under problem 323.4, Research and Development Board Project NS083-001, task 2, project 3, problem No. 4 for the fiscal year 1954.

SECTION I. INTRODUCTION

1.1 Importance of Passive Defense

The use of atomic weapons has raised a severe challenge to national defense. The scale of destruction which can be expected, together with the increasing capability of the potential enemy to deliver these weapons into the zone of the interior, make an effective defense of utmost importance.

Defense against enemy atomic attack could take several forms. Much consideration has been given to creating a capability for "massive retaliation" as a deterrent to potential aggression. Active defense measures, including radar and ground-observer detection and rapid interception of attacking weapon carriers, are also under intensive development. As a third element in national defense, passive defense cannot be overlooked.

If massive retaliation is not a sufficient deterrent and, if, as seems likely, active defense measures cannot eliminate the approaching planes or missiles, this Nation's ability to continue after atomic attack will depend to a considerable extent on the effectiveness of passive defense. Within the continental limits of the United States, the Department of Defense, and more specifically the Navy Department, has many important industrial and logistical organizations which may be affected. Thus in time of war, passive defense may be essential to the fulfillment of the mission of the naval shore establishment.

1.2 Background and Purpose of Report

A considerable amount of study has been applied at United States Naval Radiological Defense Laboratory to the problems of passive defense against atomic attack. The basic two-perimeter defense plan was developed in 1950 in the process of preparing the basic material for volume II of the series Radiological Defense under the sponsorship of the Armed Forces special-weapons project. Additional studies have been undertaken since.

The following sections represent a summary of the principles of action developed to date. This summary was prepared in response to a request by the Bureau of Ships to review a current passive defense directive and to comment on "major areas of passive-defense philosophy rather than on details." The material in this report has been transmitted to the Bureau of Ships and the Chief of Naval Operations in letter form. It is presented in report form here in order to permit broader use among persons concerned with passive defense matters.

1.3 Preview of Report

Based on fundamental considerations of the nature of atomic attack, a dynamic and flexible plan of passive defense is proposed. The major objective is considered to be the saving of lives and property in order to minimize the effect of attack on operations. A "pick up the pieces" approach involving welfare and rehabilitation functions is deemphasized. To achieve the objective of saving lives and property, emphasis is directed toward:

(*a*) Providing a system of mutually supporting passive defense units capable of operating quickly and effectively in damage control.

(*b*) Providing an adequate system to control and protect personnel under attack conditions.

SECTION II. PASSIVE DEFENSE PHILOSOPHY IN ATOMIC ATTACK

2.1 Definition of objective

Passive defense is here defined as all measures taken in defense of a place, without employment of active weapons to forestall delivery of the attack. Measures taken prior to attack include protection, deception, dispersion, and concealment. Measures taken after attack include damage control and recovery or rehabilitation. The purpose of all such measures is to minimize the effect of the attack on the target mission by reducing personnel casualties and damage to material.

2.2 Basic considerations

The basic fact arising from atomic attack is that the radius of action of the weapon's effects is large compared with the dimensions of most naval shore establishments. It is a fallacy to regard an atomic detonation as occurring within the confines of the naval installation. Rather, the naval installation must be regarded as being within the area affected by the atomic detonation. The logical consequences of this consideration are:

2.2.1 Requirement for mutual aid

It is highly improbable that the individual naval installation can cope with the effects of an atomic attack—particularly of a direct hit—without outside aid. A damage-control plan which attempts to answer the question, What will we do if we are hit by an atomic weapon? is ill conceived if the plan considers only the internal resources of the installation. Some effective system of mutual aid among installations is essential.

2.2.2 Requirement for district planning

As a result, the primary planning for atomic defense must be done on an area basis at the naval-district or river-command level. For atomic attack, the "White" plan must define defensive action in greater detail than for more localized emergencies, and must successfully coordinate the defensive resources of the entire district or command. This coordination and unity of plan for defense against the atomic attack must extend to the parallel Army and Air Force plans within the framework of directives of higher authority with respect to joint defense actions. (Where installations are located in an urban-industrial complex, it is very desirable that civil-defense efforts be conducted according to a similar plan and be coordinated with military efforts.)

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2.2.3 Dispersal of facilities and personnel

In regard to measures to be taken prior to attack, the dimensions of atomic detonations require that dispersion be seriously considered as a countermeasure. The dispersal of facilities over large areas is an efficacious means of minimizing the effect of atomic attack on naval missions. The dispersal of personnel in time should also be considered. Such dispersion employs work shifts to assure that only a portion of the work force is exposed to attack at any one time. Personnel attached to naval installations are generally skilled personnel, not easily replaced, especially in wartime. Measures to preserve the work force will probably constitute a prime goal for the defense efforts of most installations. Since dispersion often has an adverse effect on operations, the advantages and disadvantages must be carefully weighed, often at the district level or higher.

2.2.4 Damage control

With regard to damage-control measures after attack, three elements of the passive defense organization can be described:

(*a*) An external organization, concerned with mutual aid among installations and hence mobile.

(*b*) An internal organization, concerned with self-help and hence relatively static.

(*c*) A command function, concerned with control, coordination, and communications.

Each of these elements must be properly developed by the district "White" plan and by the damage-control plans of subordinate units.

2.3 Assumpations regarding attack situations

A fundamental requirement of any passive defense plan is that it must be sufficiently flexible to deal with the range of situations in which it proposes to be effective. In atomic defense planning, there are certain assumptions regarding the general attack situation that cannot be made restrictive without infringing upon this requirement of flexibility. These assumptions are:

2.3.1 Yield of weapon

Passive defense measures must be independent of the size of atomic detonation. We do not know the yield of the enemy's operational weapons. However, the United States is understood to have a family of weapons of many yields, ranging from very small to very large weapons. It is probable that the enemy has an equal range of choice. It appears to be particularly undesirable to harness passive defense thinking to the so-called nominal atomic weapon of 20-kt. yield. In general, the use of specific ranges of effects is to be avoided. It is sufficient to plan on the basis that the dimensions of the affected area will be measured in terms of miles.

2.3.2 Type of attack

The effects of atomic weapons differ widely, depending upon whether the detonation occurs in the air, at the surface of the ground or water, or under the surface of the ground or water. For air bursts, destruction by air blast and fires are the principal effects in the target. Surface and subsurface explosions cause high local destruction and a radiologically contaminating event. Passive defense measures must cope with all types of atomic attack of which the enemy is capable. An important principle in planning is to not assume that the affected area is circular or symmetrical, or that it is necessarily defined by visible damage. Winds and terrain features may make fire and contamination patterns highly directional. Further, passive defense forces may encounter radiological conditions which limit operations in regions which appear to be undamaged.

2.3.3 Number of weapons delivered

Most studies of atomic weapon attack on this country predict multiple weapon attacks. Passive defense at the district level should be based on the probability of several weapon detonations in each attack. This assumption will dictate a fluid passive defense system but should not affect techniques.

2.3.4 Point of attack

Passive defense systems based upon an assumed point of attack are static systems. As such, they are usually unable to function properly if the attack occurs elsewhere. To determine the probable point of attack, one must estimate the enemy's intentions in conducting the attack. Such estimation is questionable. Furthermore, the attack is subject to considerable error in delivery, depending upon the delivery means and the effectiveness of active defense measures. For these reasons, passive defense systems should not depend on any assumed point of attack. The system should be applicable to any postattack situation from maximum to minimum severity.

2.3.5 Time of attack

Passive defense must be on a 24-hour-a-day basis. Since many installations will be on an 8-hour day for the majority of personnel, effective mobilization in off hours must be carefully considered. Plans at the district level should indicate what defense elements are available at any or all times.

2.3.6. Warning of attack

Warning of attack is extremely important to passive defense. Presumably all practicable measures will be taken to insure warning. Nevertheless, passive-defense plans should be independent of the existence of warning; that is, a high degree of readiness should be developed in the no-warning condition.

2.3.7. Central control at district level

An adequate control center at the district level is an essential element in effective passive defense. Arrangements must be made, however, for the rapid execution of passive-defense measures in the event that the control center is destroyed or fails to function for any reason. Care should be taken not to assign command responsibilities to the district level at very early times after attack before sufficient intelligence is available to permit exercise of command. In particular, the initiation of defense measures, such as mutual aid, by individual installations should not require a "request" from the district control center.

2.4 Necessity for speed in damage control

Time is vital in passive defense. Measures tardily undertaken will probably be ineffective. Preattack measures must be independent of warning, or must minimize the required warning period. Any shelter program must face these requirements. Damage control efforts—such as firefighting, rescue, and the like—must be undertaken very quickly after the detonation in order to be fully effective. Present information indicates that initial mutual-aid groups from outside the affected area should be operating at the scene within 15 to 30 minutes after burst, and that defense elements arriving at the scene more than about 2 hours after burst will be relatively ineffective as compared to earlier efforts to establish control of the situation. These times are determined principally by the rate of fire spread and by the possibilities of a firestorm or conflagration.

2.5 Necessity for exploitation of all available sources of aid

The scale of destruction in atomic attack is so large that the available manpower and equipment of any passive-defense system will be fully absorbed by an attack of this nature. Operations will be conducted in the face of inadequate local resources and difficult logistics due to the necessity for speed in damage control. Two major considerations follow from this situation:

2.5.1 Passive defense units as cadres

The organized elements of passive defense must be regarded as a cadre organization. This requirement applies especially to the mobile-support or mutual-aid organization. Such organizations must be "open ended" so that small residual groups in the affected area and their established or emergent leaders can be quickly absorbed or coordinated into the damage-control structure. In addition, mobile support elements must plan to enlist or draft able-bodied survivors into the organization at the scene, using the trained personnel of the organization as leaders.

2.5.2 Coordination with other services and civil defense

Passive-defense planning at the district level and higher must emphasize cooperation and coordination with associated and neighboring civilian authorities and military elements of sister services. A common plan of action for damage-control measures is the most effective day to assure such coordination.

SECTION III. PRINCIPLES OF DAMAGE CONTROL AFTER ATOMIC ATTACK

3.1 Basic plan of action

Damage control is here defined as all passive-defense measures taken upon attack or upon warning of attack to minimize loss of manpower and material.

The foregoing passive-defense philosophy emphasizes the need for mutual aid among military installations in event of attack. Therefore, an adequate plan of action is essential to effective damage control ashore. At present, a two-perimeter defense plan based on a cellular defense organization is recommended as the most suitable for district damage-control plans. This plan of action is presented in Radiological Defense, volume II, pages 187 to 193. The basic features of the plan are:

3.1.1 Cellular organization

Each naval activity in the district or river command that is responsible for 2,500 or more military and civilian personnel is regarded as a "cell" in the district damage-control organization. A mobile defense unit is based on each cell. These mobile units are for the purpose of mutual aid. Smaller activities execute self-help measures only, or join in manning the defense unit of an adjacent cell. When an atomic attack occurs, one or more cells may be within the affected area. These cells execute such self-help measures as are practicable under the circumstances. Mobile defense units from cells in the unaffected area immediately move into the affected area to aid in damage control.

3.1.2 Rescue or support perimeter

If cells are well distributed in the area, mobile defense units from unaffected cells will converge on the affected area from many directions. As a unit reaches the edge of the affected area, personnel concerned with certain support functions (control, communications, transportation, medical aid, etc.) are detached to set up a control point, establishing communications with district central control and the home station control center. The ring of control points thus established constitutes the rescue or support perimeter.

3.1.3 Fire or action perimeter

The components of the mobile defense unit that are concerned with fire fighting, first aid, rescue, and radiological monitoring proceed into the affected area until halted by debris that blocks access to wheeled vehicles or by an unacceptable radiological situation. The chief fire official surveys the fire situation and determines a line at which he proposes to hold a conflagration, if such is predicted. This action line is extended laterally to the extent of the forces available or until contact is established with adjacent mobile defense units. Thus is formed the fire or action perimeter. Personnel at the action perimeter establish communications with the control point behind them on the support perimeter, reporting the situation and requesting such aid as appears necessary.

3.2 Operations after attack

The two-perimeter defense plan, just described, divides the area of operations into three zones:

3.2.1 Zone I. Within action perimeter

Zone I constitutes the area within the action perimeter. This area will be severely damaged, with many dead and severely wounded. Nearly all survivors will be injured in some manner. Time is vitally important in zone I because this area is conceded to the incipient mass fires or because radiological hazards are severe. In addition, rapid first aid and removal of injured to medical care will save many lives which would otherwise be lost. No communications will survive in zone I; consequently, no organized effort can be expected from installations in zone I.

3.2.2 Zone II. Between action and support perimeters

Zone II constitutes the area between the action and support perimeters. This area will suffer light to moderate damage. Most personnel will survive although there will be large numbers of injured, especially close to the action perimeter. Zone II is the prime source of panic and spontaneous evacuation. Studies have shown that both military and civilian personnel will tend to flee the area unless a strong internal organization is set up to prevent this action. Although organized units in zone II are the most immediate source of succor to personnel in zone I, the psychological impact of damage and injuries plus the partial or complete loss of communications make it doubtful that positive action can be expected from any but experienced combat units. Therefore, efforts to control the regressive movement of personnel in zone II must have high priority if units from outside the affected area are to be permitted rapid entry. Except for these efforts to forestall spontaneous evacuation, time requirements are not severe in zone II. Time can be taken to dig personnel from collapsed buildings and to render complex first aid to casualties at collecting stations.

3.2.3 Zone III. Outside the support perimeter

Zone III constitutes that area outside the support perimeter to a depth of perhaps 5 to 10 miles. This area will be undamaged, and all organized mobile defense units should remain effective. Movement of such units into the affected area should occur immediately upon attack. The facility with which the movement is accomplished will depend upon the level of training and the actions of personnel in zone II. At the same time, the internal organization in zone III should prevent all unauthorized movement in the zone and should prepare to support the advanced forces as necessary. Support will take the form of sending additional men and supplies and of receiving wounded personnel, uninjured evacuees, and workers returned for rest and food.

3.3 Limitations on mutual aid

The foregoing plan of operations is most effective when the number of cells involved is large. So long as naval installations alone are considered, the damage-control capability in any area will be low. The weaknesses are threefold:

3.3.1 Limitation of trained personnel

The amount of trained manpower available is small. It is estimated that on the average, 10 percent of the manpower of the installation will be available for the mobile defense unit. Since the smallest installation to man a mobile defense unit is considered to have a total manpower of 2,500, military and civilian, the minimum defense unit will contain about 250 men. A large installation, such as a shipyard employing 10,000 people, would have a mobile defense unit numbering 1,000 men. The total trained force in a naval district may not exceed 10,000 men.

3.3.2 Long distances between cells

The distances between neighboring cells will be large since only a limited number of large naval installations are located in each target area. These large distances would indicate late arrival of mobile defense units at the scene of action.

3.3.3 Varying states of readiness

The state of readiness may vary markedly over the 24-hour period if a significant number of installations are on an 8-hour day with a predominantly civilian work force. Mobilization of the defense unit in off-duty hours will be difficult and time consuming.

The solution of these problems lies in the extension of a common plan of operations not only to the sister services within the target area but also to the civil-defense organization. It appears that the two-perimeter defense plan promises the maximum effectiveness in damage control ashore and warrants development by the naval establishment. Further, the cellular concept eliminates many of the embarrassing and difficult problems of cognizance and control of forces. Mobile defense units based on miiltary and naval installations need not differ in principle from those based on large private industrial plants and on civil subdivisions, such as police precincts or fire districts. There is no need for military defense units to be turned over to civil authorities or vice versa during atomic attack if a joint control center is developed to provide adequate coordination.

3.4 Mobile defense operations

Three basic operating problems face the mobile-defense or mutual-aid portion of the damage-control organization during the period from attack to 12 hours after attack. The detailed plan of operations for any target area should be designed to meet the following problems:

3.4.1 Rapid movement of units

Organized elements must be moved into the affected area rapidly. Initial elements must be at the action perimeter not later than 15 to 30 minutes after burst.

3.4.2 Rapid removal of survivors

Survivors in the affected area must be removed to the support perimeter rapidly. Rapid removal is essential if injured are to be treated effectively.

Organized medical support should be located on the support perimeter Uninjured survivors must be channeled to the support perimeter for control, for organized evacuation of nonuseful persons (elderly persons, children, etc.). and for assimilation of useful survivors into the damage-control effort.

3.4.3 Rapid expansion of forces

The organized work force must be expanded rapidly at the scene of action. This expansion can be accomplished most effectively by drafting useful survivors into work parties at the control points, using the members of the mobile defense units as leaders. The defense units are thus a true cadre organization.

3.5 Self-help operations

The internal portion of the damage-control organization of a naval installatiton is concerned with the protection and control of the personnel who are not a part of the organized mobile-defense force. The need for control of the actions of all persons in the target area cannot be over-emphasized. Lack of discipline or control can convert an emergency into a disaster in a matter of minutes, defeating all efforts at damage control. Since the mobile-defense force is not likely to involve more than 10 percent of the work force, the internal or self-help organization is responsible for the major portion of the work force. The basic requirement is the development of an effective warden system. The normal supervisory organization should be used for this purpose. Supervisors should be trained to take the actions necessary to protect and control the personnel who are normally under their immediate cognizance. The rank and file should be trained to look to their supervisor in case of emergency. The following considerations should guide the development of the internal organization:

3.5.1 Establishment of shelter-assembly points

Adequate shelter-assembly points should be established within the installation. These areas should be carefully chosen to provide the maximum protection possible against the expected attack. If warning of attack occurs, all personnel should retire to the assigned shelter-assembly area. If attack occurs without warning, the shelter-assembly areas become assembly or rallying points for survivors from which controlled action (evacuation or damage control) can take place.

3.5.2 Storage of supplies and equipment

Shelter-assembly points should also be the storage points for first-aid supplies. hand fire-fighting equipment, radiac instruments, and similar emergency equipment.

3.5.3 Communications

All shelter-assembly points should have at least telephone contact with the station-control center, so that command can be exercised. Emergency communication equipment is also desirable at shelter-assembly points if available.

3.5.4 Capacity of shelter-assembly areas

Approximately 50 to 100 persons should be assigned to a shelter-assembly area as a general rule. Large numbers of smaller shelters are difficult to control from a central control point. Larger shelters run the risk of lack of control within the shelter by the senior person present, with resulting panic and loss of control.

3.5.5 Control of personnel actions

Actions of personnel in shelter should be controlled by the station-control center so long as communications exist. If the attack destroys communications, the senior person present in the shelter-assembly point should take the actions necessary to execute local damage control and to evacuate survivors and injured to safe areas. Close control of evacuation is mandatory so that the rapid movement of organized defense units is not impeded.

3.6 Command and coordination of operations

The command function in an atomic emergency should be centralized at a well-protected station-control center. In order to exercise command, the control center must be set up to evaluate the emergency situation rapidly and correctly. To make such an evaluation requires an effective means of acquiring information on the situation, and also requires personnel trained to evaluate this information properly. The communication system is the basic means of acquiring information. Communications should be developed between the control center and the following:

(a) All station shelter-assembly areas.

(b) The mobile-defense force, both while moving and when at a control point.

(c) The district control center and the control centers of sister installations.

Personnel in the control center must be trained to evaluate fragmentary information correctly and to recommend the appropriate actions to be taken. Since central control depends on effective communications, senior persons in the mobile-defense forces and in shelter-assembly points must be delegated authority to take appropriate action in event of loss of communications.

3.7 Training for passive defense

An important element in implementing these plans is training. Training material for passive defense against atomic attack must be integrated with the foregoing philosophy and principles. In particular, the following points are crucial:

(a) Instructions to individuals not assigned special duties must be designed to establish control of actions. Present indoctrination does not lead to establishment of control.

(b) Supervisors and other control individuals must be selected and trained to provide maximum protection and control and to instill confidence in personnel that control leadership will preserve lives.

(c) All individuals in mobile-defense forces must be trained as leaders, while the manpower sources in the target area must be relied upon to provide the rank and file of the damage-control effort.

Approved by:

Paul C. Tompkins,
Scientific Director.

Exhibit 5

AN INTRODUCTION TO DISASTER PSYCHOLOGY

USNRDL Reviews and Lectures No. 4, September 8, 1955, by W. E. Strope

MILITARY EVALUATIONS GROUP

United States Naval Radiological Defense Laboratory

SAN FRANCISCO, CALIF.

An Introduction to Disaster Psychology [1]

By Walmer E. Strope [2]

In 1917 an ammunition ship blew up in the harbor of Halifax, Nova Scotia. The ship contained 3,000 tons of TNT. In the terminology of the atomic era, this would be called a 3–kt detonation. Of course, it was a conventional explosion with none of the radiological implications of atomic attack.

Nonetheless, the blast was devastating to the port city of Halifax. The northern part of the city was destroyed, more than 1,800 people were killed, approximately 20,000 others were injured, and many more thousands were rendered homeless in the dead of winter.

There were several official reports of inquiries into the causes and effects of the Halifax explosion. Sociologists and other scholars also studied various aspects of the disaster. These reports are united upon one fact. They each note with some surprise the magnificent performance of a small group of people, who were among the heroes of the Halifax disaster.

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[1] From notes of lecture given by author. The lecture notes reproduced herein are based on the research and findings of various investigators in the field of disaster psychology. Acknowledgment is given to these investigators, especially to the authors of the publications listed in the footnotes.

[2] Head, Military Evaluations Group, U. S. Naval Radiological Defense Laboratory, San Francisco 24, Calif.

This group of people quickly went to the aid of the survivors, organizing the first relief station at Halifax. This was in operation by noon of the day of the disaster. Who were these people? And why was their heroism thought to be unusual?

They were a company of traveling actors who were performing at the local opera house at the time of the explosion. In 1917, the acting profession was not considered to be a particularly useful and acceptable part of society. Actors were generally held to be rather peculiar, somewhat irresponsible, and thoroughly self-seeking. Why, then, did a troup of actors becomes heroes when a major disaster visited the city? At the time, no one know. It didn't seem reasonable from any point of view. Therefore, it was put down in the record as one of those fantastic and unexplained occurrences that are part of the lore of all human catastrophes. Let us keep this incident of the Shakespearean actors in mind for a while. We will come back to them a little later and, at that time, I think we will understand why they, rather than anybody else, were the heroes of Halifax.

In the decades since the Halifax disaster, science has developed new theories of human behavior and of social organization. Powerful techniques of analysis have been developed to deal with the problems of group psychology. The results of research in this field by teams of sociologists, psychologists, and other workers have provided a great deal of insight into the general problem of the behavior of people in the midst of disaster. Now we think we know some of the important reasons why some people become heroes and why other people run away. Since this is very important to us in planning a defense against atomic attack, it is proposed to summarize these studies and to apply them to the field of atomic defense.

The first step required in discussing human reactions to disaster is to define our terms. The first question is, of course, What is a disaster? There are a number of possible definitions of this term, but the definition which has been found to be most useful is the following:

DISASTER IS AN UNSTRUCTURED SITUATION

What do we mean by an unstructured situation? Perhaps the best way to arrive at an understanding of this term is to consider first its opposite—the structured situation. By saying that a situation has structure, we mean that there exist certain reference points or facts in the situation that provide one with guides for action. Consider, for example, a conference in the office of the executive vice president of a large manufacturing firm. Attending are representatives of the design, production, and sales departments with their assistants, the purchasing agent, the finance officer, and several members of the executive staff. The question is whether to produce a new model of the company's product. The words and actions of the people present will be guided by the structure of the situation. Each is aware that he is a member of the top management of the company. Each knows his particular position in the organization and the responsibilities and prerogatives which go with it. Each knows the relationship of the other people at the conference to him in terms of superior and subordinate or on parallel levels of responsibility. Perhaps the company's financial position or sales record is part of the structure. The conferees also know that the conference will soon be over, and are laying plans for lunch. They are thinking of the work they have planned for the afternoon. They know that, when quitting time comes, each will travel home, and perhaps they have plans for the evening. This is the structure of the situation, and it is sufficient to guide the actions of all concerned.

Suppose at this point the building should sway violently and the lights should go out. Perhaps the windows are shattered and a sharp shock is felt. These events are unexpected, they do not fit the previous structure. Suddenly plans for lunch or for an evening's outing are meaningless. The topic of discussion, indeed the conference, is suddenly unimportant. Each individual is confronted with a crisis. The burning question is: "What shall I do?" If the emergency is severe, the normal relationships of executive and subordinate and the other social relationships lose their significance. It becomes every man for himself. Since the normal guides for action have disappeared (that is, they no longer seem to fit the situation), we say that we are faced with an unstructured situation. This is what happens in a disaster.

In an unstructured situation, the usual guidelines by which people act, order their thoughts, and consider what they are going to do next, either consciously or subconsciously, disappear or become manifestly meaningless. People are left, momentarily, at least, as a ship on the wide ocean without a compass, not knowing where they are, nor which way to go. This concept of an unstructured situation is fundamental to a consideration of human reactions to disaster. It will be found at the roots of any disaster, whether it is an atomic attack or a serious automobile accident. Of course, some emergencies are not truly disasters since some structure remains in the situation. In a true disaster, there is no apparent structure.

Psychologists who have studied large numbers of disasters have been able to analyze human reactions to an unstructured situation and have been able to formulate broad statements regarding these reactions. They find that the initial effect of an unstructured situation or disaster on human beings is to render them immobile. The term used for this reaction when a disaster occurs is "stun."

PEOPLE ARE MOMENTARILY STUNNED BY AN UNSTRUCTURED SITUATION

People at Texas City, for example, spoke of being frozen into momentary immobility, of not knowing what had happened, or what to do next. A study[3] of the Texas City disaster reaches the following conclusions: "The shattering of normal expectations by an unexpected even presents the individual with an unstructured, undefined situation in which he does not know what to do." The shock reaction at Halifax has been described[4] as "being suddenly stricken with blindness and paralysis." Some of this sensation of disability and helplessness may be due to physical forces such as blast concussion and the like, but the effect of "stun" is also seen in people who are no subjected to any physical force. It is therefore more probable that it is purely psychological and is to be explained in terms of the unexpected and undefined nature of the situation.

The stun reaction is acütely so common that most readers can recall a personal experience such as a highway accident in which they experienced the momentary sensation of paralysis and helplessness. This reaction has important implications in terms of atomic defense. Common in atomic defense literature are instructions for self-preservation which call for individuals to dive for a ditch or a doorway or to go under a desk or a table when a brilliant flash of light occurs. One is permitted to question, on the basis of disaster psychology, whether these instructions are really useful in reducing casualties, particularly for populations which are neither well trained nor experienced in the face of atomic attack. Certainly, for at least a moment, the first reaction of people will be the immobility caused by "stun."

The next major finding in disaster psychology is that people cannot act in terms of an unstructured situation. It has been shown experimentally that individuals will find structure in a situation even if they must create their own reference points. If the individual finds no reference points on the basis of which he can define the situation for himself, his first move will be to seek one. This is a very fundamental and deep-seated human reaction and can overpower other motivations such as self-preservation.

In the following statement, Logan et al.[3] describe the actions of individuals attempting to structure a situation: "To observers the actions which take place at this time are likely to appear irrelevant and even irrational. In terms of the usual norms and standards of a stable situation, or in the light of later knowledge of what the situation was at the time, they may be irrelevant. But in terms of the limited knowledge available to the actor in the unstructured crisis situation, such actions may be highly appropriate."

It is important to remember that the drive to structure a situation is basic and will override all of the so-called normal referents by which people habitually govern their actions. In combat situations, it is often noted that men will place themselves in jeopardy or actually be killed in an attempt to structure the situation. For instance, when an unexpected event occurs, men will raise their heads out of foxholes or trenches despite enemy fire. They are driven to do so by an unstructured situation.

In one account of a tornado incident, people in a motion-picture house tried to get out into the street, although the theater was obviously the safer location.

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[3] ORO–T–194, A Study of the Effect of Catastrophe on Social Disorganization, Logan, Killian & Marrs (1951). (The rationale of this paper is drawn from pp. 94–96 and pp. 102–109 of the above reference.)

[4] S. H. Prince, Catastrophe and Social Change, vol. XCIV of Studies in History, Economics, and Public Law, Columbia University, 1920.

A major factor in this move toward the exits was undoubtedly the drive to find out what was happening.

Another example of the drive to structure the situation is found in several accounts of the Texas City disaster. A young woman was trying on a foundation garment in a lingerie shop when the Grand Camp exploded. She rushed into the street in an extreme stage of undress. As soon as she saw that she was in no danger, she was overcome with embarrassment at her situation. Later she repeatedly stated that she couldn't understand how she could have done such a thing. When asked, however, why she ran into the street, she answered simply, "I wanted to see what had happened." In short, she was trying to structure the situation. Her motivation in this respect was able to override her normal modesty so that, in retrospect, she could not understand how she could have done it. Nevertheless, it is obvious that in the unstructured situation in which she found herself, she gave no thought to normal standards and was driven by very strong psychological forces to try to structure the situation.

Returning to the subject of emergency atomic defense actions for individuals, it appears improbable that the office worker will quickly dive under his desk when the brilliant light flashes. More likely, he will freeze for a moment, then turn and look out the window in an attempt to structure the situation. When he does so, he will be staring death in the face. If these casualties are to be avoided or minimized, we must have strong windowless buildings, or else the training given individuals must be sufficiently intensive and realistic so that the situation is immediately recognized for what it is. Such training neither exists nor is contemplated at the present time.

How do people go about defining or structuring a disaster situation? Firstly, individuals must structure the situation on the basis of the information available to them; that is, in terms of what they see, hear, feel, and smell. Secondly, they must interpret or evaluate this information on the basis of their previous experience. If an individual has access to a large amount of information on an unexpected event, a reasonable structure can be obtained quickly based on very little experience. As the amount of information available becomes less and less, either more and more experience and training are necessary to evaluate the situation correctly or, what is more likely, an incorrect structure will result.

Thus it is usual that people tend initially to underestmate the extent of a disaster, since the individual encounters only a fragment of the whole catastrophe. Underestimating is particularly true in the most devastated areas where knowledge is most limited. Leet, in describing the Japanese earthquake of 1923,[5] notes: "A curious psychological twist at such times is the conviction each person has that he is at the center of the worst disturbance. I didn't occur to people in Tokyo that Yokohama was badly affected, or the reverse." He tells of the newspaper publisher who was vacationing in the mountain resourt of Karuizawa at the time. The resort town was shaken but undamaged by the earthquake. The publisher rushed a telegram to Tokyo to hold the presses for a story on the Karuizawa quake. At this time, Tokyo was being destroyed by flames.

Since, in major disasters, individuals usually have a very modest amount of information on the extent of destruction, a heavy burden is placed on their experience and training in order to structure the situation adequately. Most people have no direct experience with atomic attack. We may hope they never have. Unfortunately, they also have practicallly no training to make up for their lack of experience. Therefore, it is likely that for most, the disaster situation will be poorly undertood.

As an example, it was noted at Hiroshima that people put a common structure on the situation. Everywhere people were seen searching for the site of the explosion, each convinced that a large conventional bomb ha been dropped in the immediate neighborhood of his shattered house. This was only natural because the atomic bomb was unknown at the time of the Hiroshima attack. People in the first atomic disaster tended to evaluate what they experienced in terms of what they had previously known or had been trained to know about. Since then, the atomic bomb has been well publicized and in some explosion disasters since the war, many persons have structured the situation as being one of atomic attack. This was noted, for instance, at South Amboy, N. J.

In summary, people structure a disaster situation on the basis of the information available to them and the evaluation of this information whch they can make in light of their experience or training. Since in most cases the informa-

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[5] L. Don Leet, Causes of Catastrophe, Whittlesey House, copyright 1948, by the McGraw-Hill Book Co., Inc.

tion available to the individual is very meager, being limited to what he can see in his immediate surroundings, and also since disaster situations are generally outside his experience(and often outside his training), there is a common tendency to assess the disaster in terms of the situation in the immediate vicinity. Such structures generally lead to uncoordinated, divergent, and inappropriate action when viewed in relation to the total situation.

At Hiroshima, there was a complete lack of any coordinated disaster control effort for several days after the attack. We may surmise that one cause of this condition was the inability of the population to structure the situation for what it was. It has already been noted that large numbers of inhabitants of Hiroshima were convinced that a small bomb had detonated in their immediate vicinity. How long did it take before the majority of the population realized that the whole city had been destroyed? How long did it take before people in the zone of light to moderate damage realized that they were not actually "at the center of the worst disturbance," and that there were more seriously affected townsmen nearby who were desperately in need of help?

It is worthwhile to point out that a primary justification for developing a disaster-control organization and for setting up a civil defense or passive defense control center is the need for properly structuring a disaster situation. If a control center is in communication with a number of regions or zones in the target area, it has available to it far more information on the situation than has the ordinary citizen. Even loss of communication with a region constitutes information in the disaster situation. Furthermore, a control center can be staffed with a few persons whose experience and training can be made much superior to that of the average man. These people are then able to evaluate even limited information better and faster than the general population. If an accurate structure of the situation can be disseminated quickly to the surviving population in the target area, the possibilities for appropriate and effective action are immeasurably increased.

We have seen that people are momentarily stunned by the occurrence of an unstructured situation. Since people cannot act in an unstructured situation, the first reaction afer the "sun" is an attempt to structure the situation. Only after the new situation has been structured can a person proceed on some course of action. What do people do when they have structured the situation—rightly or wrongly? They generally act in terms of those personal values which seem to be most threatened.

What these values are varies with the local situation. In the severely damaged area, the individual's life is likely to be endangered, and therefore acts of self-preservation are the rule. Of almost equal importance are the lives of other people in the immediate vicinity. This statement may appear surprising, but it has been observed consistently that in our culture, human life is a fundamental value, one that does not lose its significance even in disaster. It has been found that even badly injured people have acted to help others near them almost as readily as they acted to save themselves.

If a person finds that his own life is not in danger, his next thought is generally for the safety of the primary group with which the individual associates himself. Thus people attempt to find and help the members of their primary group by rushing toward the places where they are believed to be.

It is interesting at this point to consider the difference between a military organization and a civilian community when disaster occurs. Over the centuries military organizations have developed in ways that take advantage of the basic human reactions to disaster. The military organization, of course, finds it highly desirable to encourage the individual soldier or sailor to preserve his own life. In fact, the punishment dealt both adversaries is usually measured in terms of casualties, and any means of minimizing one's own losses or of achieving a favorable casualty ratio with respect to the enemy's is of military importance. Since self-preservation is a fundamental human motivation, military organizations have no difficulty in fostering this reaction.

If the individual is satisfied that his own life is not in immediate hazard, he then is motivated to aid in the survival of his primary group. In the military, the primary group is the squad or platoon or section. So the individual tends to go to the aid of his buddies. The platoon seeks the survival of the company and so on. Military organizations rather carefully insure the development of esprit de corps or group association as an aid in battle. Exeperienced officers always request a unit as a work party, even in noncombat situations. They have found that there is a great difference between a squad and 12 men. In combat, such group relationship are vital. They are important because the psychological drives of the individuals tend to concentrate on and preserve the organization.

In civil life, we have a quite different situation. Most people regard their family as their primary group, so that the tendency, after satisfying the need for self-preservation, is to try to preserve the family. During the daylight hours when the children are at school, the husband is at work and the wife is at home, the family is widely separated. The psychological drives just discussed do not lead to control of the situation and preservation of the organization. On the contrary, the organization is torn to pieces, with large numbers of people rushing over the countryside looking for their primary group. This human reaction is very strong and can be seen in people who, as will be discussed later, we should expect to forego this reaction.

For example, in a study[3] of a tornado incident in Oklahoma, it happened that the police chief was en route between a neighboring town and his home town at the time the tornado struck. He could see the tornado as it passed through the town and could see that a great deal of damage had been done. Although he had an important role as police chief in such a distaster, his first act as he came into town was to drive to his home and establish that his family had not been affected. Only after this was done did he go to the scene of the disaster and take charge.

Another social group to which many people belong is the work group; people with whom the individual lives and works during the daytime. In most cases, the ties to this group are very strong. If management is aware of these group relationships and acts to utilize them in preparing for atomic defense, it may be possible to strengthen those motivations which will maximize group survival and to minimize those drives which can only lead to disorganization, panic, and additional loss of life.

The foregoing description of human reactions upon structuring a disaster situation is true for most individuals, but it is not true for a very significant minority: people that have been called role persons. The role person is of fundamental importance to atomic defense. What is a role person? He is an individual who conceives of himself as being especially qualified to do some job in the new situation and he tends to act calmly and quickly to do this job in spite of the confusion that prevails about him.

The role which such a person sees for himself in the disaster situation is not necessarily one which he is accustomed to playing in everyday life nor need it be one to which he has been arbitrarily assigned in some disaster plan. It is a role, however, for which he feels himself prepared. It is a role in which he feels that he will be doing something useful, no matter how small. A true role person is convinced that the role he performs is superior to any other action he could take. Therefore, when necessary, he is able to sublimate his fundamental drives toward self-preservation and toward preservation of the primary group.

Many people are role persons because of their background, personality, and training. For instance, doctors are usually role persons. A doctor will generally act to aid the injured with little or no hesitation or confusion when disaster strikes and with litle concern for his personal situation. Public servants such as policemen, firemen, utilities workers, and the like are also probable role persons in an emergency. In all of these cases, the individuals tend to perform the roles for which they have been trained and which they normally pursue in everyday life.

There are however, other individuals who become role persons in a disaster for less obvious reasons. In the Texas City disaster, a minister reacted as follows: "After I heard the explosion, my first impulse was to go down to the docks and try to help there. But when I saw 2 or 3 women whom I knew had husbands down there, I realized that my job was with the families, not doing rescue work. I had a job that I was peculiarly suited for, prepared for and I felt that I should do that." This is a good example of the arising of a role person in a disaster situation.

As another example, a machinist in Texas City stated to the interviewer, "As soon as I had gotten out of the machine shop and realized that there had been a terrible explosion, I went right over to the first-aid station at the plant. You see, I'd had first aid-training and I thought I could be of some use there. I asked if I could help and they said, 'You sure can'. The nurse in charge told me to gather up some supplies, take a truck, and go down to the docks."

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[3] See p. 2607.

It might be worthwhile to analyze this statement by parts. "As soon as I had gotten out of the machine shop"—Why? He had to structure the situation. "And realized that there had been a terrible explosion." This was the structure he perceived. "I went right over to the first-aid station at the plant." Note the prompt and calm reaction. "You see, I had first-aid training and I thought I could be of some use there." Here was a role for which he felt prepared and which he regarded as superior to any other course of action for him. The fact that he apparently ended up as a truckdriver is of small importance. This machinest saw something to do for which he felt qualified and immediately became an organizing and working influence in the disaster situation.

In many disasters, it has been found that women who have had nurses-aid training reported immediately to hospitals where they believed that they would be needed. One cannot escape the conclusion that very real results could be expected if industrial organizations offered their secretarial help such training as part of the on-plant development program.

From the foregoing examples, it is apparent that there are many people whose usual occupation roles would give no indication of what they should do, but who have perceived that they had other talents that would prepare them for a role in a disaster situation. Perhaps from simple self-inquiry, "What would I do in case of atomic attack"—a role person may result. Such role persons are a very important organizing influence in the face of disaster.

Conversely, much of the confusion in disasters stems from the presence of people who do not know what to do and who can see no role for themselves in the situation. People who tend to panic and who make up the spontaneous evacuation that often occurs after disaster are often of this type. In Texas City, there were people who said, "I didn't see anything I could do here so I left." After a tornado incident, one of the city fathers said, "One of the things that worried me most was that so many people didn't know how to take hold and do something. They didn't know what to do." These are people without roles.

One of the chief characteristics of a role person is that he is able to structure the situation resulting from disaster quicker and better than the people around him. However, he has only the same information that the people around him have. Therefore, his ability to structure the situation must come either from experience or training. Indeed, in civil disasters, many role persons are individuals who have in the past experienced similar events. They are the equivalent of the "combat-hardened" military man. Many role persons are able to structure the situation adequately on the basis of training. This may be a formal training or it may be simply that through reading and through thinking about what he would do if such a situation were to occur, the individual is able to interpret what he experiences in terms of a previously thought out structure.

In this event, the role person is able to act quickly while most of those around him are still trying to structure the situation. When he does so, his actions are noted by the individuals around him and since they are hunting for guidelines for action, what he does forms a basic part of their structure. They note his actions and, recognizing their meaning, are quick to join him in whatever he is doing. People in an unstructured situation have a desperate hunger for a structure and for a clear-cut line of action, so that a role person can quickly become the focal point for the actions of a group of perhaps a dozen people. We might say that persons in an unstructured situation tend to mimic the actions of others. That is, they may not fully realize why the action is being taken, or whether it should be done, but they find themselves drawn toward anyone who apparently knows what he is doing. The role person exerts "silent leadership" in the group and therefore is a powerful organizing influence.

When the city of Flint, Mich., was struck by a tornado recently, the civil-defense director of a small town about 25 miles away drove to the disaster scene as soon as he heard the news. He found a number of citizens bewilderedly surveying the shattered homes in the damaged area. He proposed to search the wreckage for possible survivors and was joined by the standers-by in doing so. The following day State officials surveying the scene noted the activity and asked the workers who had directed them to do the rescue job. The men, pausing in their task, replied that an unknown man who seemed to know what he was doing had started the search the night before and since it seemed a good idea they had continued the effort all night. This is perhaps an extreme example of the powerful influence of a role person on the actions of other.

Unfortunately, the tendency to mimic can also have bad consequences. Where on the one hand the mimicry may be highly desirable because the group is following the silent leadership of a person who is performing a needed role, on the other hand they may follow a person who is playing a faulty role or who actually has no role at all. Spontaneous evacuation and panic may stem from this cause, where a few people deciding to leave "carry" a much larger group with them. These followers may, under better circumstances, have fitted themselves into a controlled situation.

The Mann Gulch fire of 1949 was a forest-fire disaster in which 13 firefighters lost their lives. They were a group under the leadership of a man named Dodge, who, when it became evident that the group was trapped, set a small escape fire in the meadow. The escape fire created a burned area within which Dodge survived although the rest of the group failed to follow him. The report of the board of review [6] states:

"The evidence is not conclusive as to how many of the crew understood Dodge's purpose in setting the escape fire and heard his directions to join him inside the burned area. The situation was complicated by the noise of the main fire and possibly by the remark of one victim, as heard by some of the men, 'To hell with this, I am getting out of here.' Evidently each individual followed either his own interests at this point or the example of those ahead of him who were making their way up or across the slope."

"Dodge showed coolness and good judgment in setting the escape fire. Both survivors and Sylvia said they believed that all the men would have been saved if they had followed Dodge's lead in getting into the area burned by the escape fire."

This indeed is one of the major problems with which any atomic defense or disaster organization is faced. We know that role persons will arise in the situation. We know that some of these people will be playing roles that are highly desirable. We know that others may be playing roles that are going to increase the loss of life or are likely to interfere with the saving of life by others. A major effort must be made to assure that the roles that people play are those that are the proper ones in the total situation. Such an effort must also include role persons of the highest degree. For example, it has been stated that doctors are generally role persons. They will treat injured persons wherever they find them, irrespective of their own safety or thoughts about their loved ones. But this may not be the role that we would like to have a doctor play. It might be better for him to go immediately to a first-aid collecting station or a hospital where he can treat a vastly greater number of injured in the same period of time and with more effectiveness than he would be able to do in scrambling through the ruins. If this is the case, then the doctor must be trained to the proper role. He must be convinced that the proposed role is the best for him. Once he is convinced of this, it will guide his actions as a role person.

Other examples of improper roles have occurred in civil disasters. In one tornado incident, the police chief, rushing from his home toward his office, stopped on the main business street and became a mere guard, protecting the stores there from looting. The sheriff became directly involved in rescue work as a worker since several branches of his family had lived in the path of the tornado. These men played useful roles but they failed to assume the position of leadership for which they were qualified and which would have resulted in more effective disaster control.

Effective atomic defense will depend in large measure upon the number and type of role persons involved in the emergency. Effective leadership is more important than facilities or equipment. There is rarely anything needed in a disaster area that isn't already there—hardware stores full of tools, acres of abandoned vehicles, grocery stores full of food, department stores, hotels and motels, gas stations full of gas. What is usually in short supply are people who understand the jobs to be done and who do them.

It is interesting that military organizations have developed the role person concept to a high degree, perhaps without realizing it. Compared with civil populations, the military are therefore highly immune to disasters. Not only is the organizaiton able to take advantage of the basic human motivations in disaster, but there is a constant program in the military forces to develop every individual in the organization as a role person. The program starts with basic training and proceeds through successive stages by which men are trained to play particular roles under adverse circumstances.

There are degrees of role persons, and the military recognize this fact. When men are put into the front lines for the first time, the Army is usually careful

[6] Report of Board of Review, Mann Gulch Fire, Helena National Forest, August 5, 1949, U. S. Forest Service.

to intersperse these green personnel among units that have combat experience. In this case, the combat veterans act as role persons and have a controlling influence in the action that ensues.

It would be an ideal state of affairs if an atomic attack we could have every person a role person playing a proper role. At the present time, this is far from the case and perhaps a more practical target should be proposed. As a rule of thumb, it may be said that if one can be sure that 1 person in 10 in a disaster area will act as a proper-role person, then control of the situation and maximum saving of life and property can result. That is, each role person can take with him, on the basis of silent leadership and example, something of the order of 10 other persons who otherwise might be doing nothing, doing the wrong things, or blindly attempting to escape a situation in which they can see no hope. Of course, it would be desirable to have more role persons than 1 in 10. Therefore, atomic defense organizations should aim at creating as many role persons as possible. Only in this way can we be sure that our people will have the maximum chance of survival.

Now let us return to the city of Halifax and the members of the Academy Stock Co. Why were these play actors heroes at Halifax? Whey were they role persons? Regardless of their other traits, actors are trained intensively in playing roles. Each evening they become another person. The degree to which they do become another person indicates their stature as an actor. One cannot know whether these actors had ever acted in a play involving a natural disaster but certainly they were adept at playing roles. When the disaster occurred, it was their natural impulse to play a role. The role they chose as a group to play turned out to be very excellent. Prince[4] says, "Thus it came about that the soldiers, firemen, and play actors may be called the disaster protocracy. They were 'the alert and effective,' the most promptly reacting units in emergency."

Some conclusions with regard to atomic defense are warranted. Certainly one of the principal jobs is to create a large number of role persons and to train them to play the roles that are found to be the most important. While limited numbers of personnel are being organized and trained intensively, the broad base of the population should be indoctrinated with sufficient knowledge to encourage proper structuring of the situation. They should be exposed to the bare essentials regarding emergency action to save life—fighting fires, conducting rescue, and so on.

Existing primary groups at work locations, at home, and at school should be utilized in organizing for atomic defense. Supervisors, family heads, and teachers should be singled out for development into role persons. Their training must be such as to assure maximum protection and control of members of the group and to instill confidence in group members that control leadership will preserve life.

The immediate value of an organization in time of disaster is the ability to structure the situation more adequately and more quickly than the individuals involved. The magnitude of atomic effects makes this function particularly important. Communications are therefore essential to organized atomic defense. If the control center is not provided with the means of acquiring the necessary information on the nature and extent of the disaster, it may form a more erroneous structure of the situation than many subordinate elements or persons who are directly involved. In this event, attempts to control the actions of others will be fruitless. People involved in the disaster will usually ignore nonsensical instructions—instructions which patently are not in accord with the situation.

Of equal importance is the provision of adequate communications for the dissemination of a structure to the whole target population. It is not enough to advise a limited organization while the vast majority of the survivors are forming their own structure and proceeding to act accordingly.

Finally, all disaster organizations should be open-ended; they must not be conceived as a closed corporation. Members of atomic defense organizations should all be trained as leaders. They should be alert to recognize emergent-role persons in a disaster and quick to accept and utilize their valuable efforts. Any disaster plan that depends entirely upon the predisaster organization is a bad plan. The door must be left open for nonmembers to help. When the chips are down, they will help—better than many.

W. E. STROPE.

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[4] See p. 2607.

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STATEMENT OF DR. DONALD N. MICHAEL, PSYCHOLOGICAL CONSULTANT, WASHINGTON, D. C.—SOME PSYCHOLOGICAL FACTORS RELATED TO SHELTER TAKING COMPARED WITH THOSE ASSOCIATED WITH TACTICAL EVACUATION

The following comments are not meant to be exhaustive in any sense. Nor are they meant to be definitive: again, as in the main statement, these predictions are not intended to be final. But since what I suggest herein could happen, it is incumbent upon us that we do all we can to maximize the likelihood that desirable behavior will occur and minimize the likelihood of the undesirable arising.

1. PEACETIME INDOCTRINATION AND TRAINING

Shelters are specific and identifiable evidence of postive civil-defense efforts—far more so than an evacuation route which after all is simply a highway which during peacetime has essentially no specific civil-defense function. Hence during peacetime, shelters would make civil defense much more real in the minds and eyes of civilians and as such provide a motivating basis for a more wholehearted participation in civil-defense exercises. The existence of shelters is very likely to induce a popular belief that something positive can be done to provide protection in the event of atomic attack. This increased participation and belief in civil defense is likely to be especially noted in those cities where there is at present a popular belief that, because of the configuration of the city, evacuation is doomed to fail.

Moreover, it would be much easier to provide realistic survival behavior practice and exercises with shelters than with evacuation. For example, if people go to shelters they in fact reach the goal of their survival-seeking behavior; when they evacuate no real goal is provided unless they actually evacuate to a refugee encampment and live there for a bit under "combat" conditions; and even then there is an inconclusiveness about the environment which would not occur in the shelter-taking situation (e. g., a trip to the country has pleasant associations, not grim ones). It is amply clear from experiments on the learning process that the symbolic and behavioral conclusiveness of the shelter-taking condition is far more likely to provide superior learning of survival behavior and far more likely to provide superior motivation to learn than would be the case with the evacuation situation.

2. FROM THE "YELLOW ALERT" TO "ATTACK IMMINENT—TAKE COVER"

If people believe that the time from warning to attack will be short, if they perceive the evacuation route as long and the outcome of traveling it vague and the security at the end of it ambiguous, there may well be paralysis and despair especially in those cities in which the inhabitants doubt the efficacy of evacuation in the first place. Many may subscribe to the philosophy that it is preferable to die in their homes than on a jammed road—especially if the warning comes at night or during inclement weather. If, on the other hand, people believe that the shelters will give them some chance of survival, and if they perceive the shelters to be near enough to get to even if time is short, there will be many who would reject any evacuation effort who will go to the shelters. This is especially so if they have had adequate peacetime practice at going to shelters under all sorts of conditions; and, as indicated earlier, it is easier to provide adequate shelter-taking practice than evacuation practice. Even if it is assumed that people would just as soon attempt to evacuate as to take shelter, the fact that there would be less physical distance to cover and fewer physical activities involved in getting to a shelter than there would be in getting out of town means that there would be far fewer opportunities, in the shelter-taking situation, for disorganized behavior or panic to arise. Moreover, the greater sense of security provided by the knowledge of the proximity of shelters and the belief that they will offer some protection will probably reduce anxiety and thereby reduce the likelihood of disorganized behavior and, concurrently, panic.

A countervailing tendency to prefer evacuation to shelter taking which may predominate in some quarters can be described by the expression, "I'd rather have a quick, clean death out in the open than be buried alive." For Americans, for whom horizontal mobility has always been a classic means of avoiding an undesirable situation, the appeal of evacuation compared to shelter taking may be sufficient to require counteracting informational and educational efforts. Given what appear to be the facts regarding shelter and evacuation, and given some other strong American values which can be used to popularize shelters, (such as the likelihood that shelters will provide better health protection, and that they will make it easier to keep families together or appraised of each other's whereabouts) such an educational campaign is very likely to be successful.

If enough shelters and ingresses per shelter are constructed, then the number of people who must cross a given cross section of survival channel in a given time can be made small. Thereby the possibility of panic or disorganized behavior can be reduced and the number of people per panic or disorganized behavior incident can be reduced since there would be fewer people attempting to use a given ingress. It would seem easier to increase the number of shelters and ingresses to shelters than it would be to increase the number of highways out of cities and their ingresses to adequate support area shelters. (Panic or disorganization at shelter entrances due to blockages from people who have fallen down and have difficulty in getting up because of the pressure of those pushing in behind them (as in the Bethnal Green tragedy in England in World War II) could be substantially reduced by zizzagging the ingress pathway.)

If people have predetermined shelters to go to, the anxieties of separated family members can be somewhat reduced since family members will be more assured that the rest of their family will reach the possible safety of a shelter and that after the attack it will be relatively easy to find ther. Thus, the amount of disorganizing and survival-impeding searching behavior will be reduced. Of course this searching behavior problem will not be eliminated nor will the anxieties of separated family members since it will be evident to these members that daily activities may put members in areas where they will use other than the predetermined shelter. However the shelter situation should be more reassuring than the evacuation procedure.

3. FROM WARNING OF "ATTACK IMMINENT" TO THE BLAST

In evacuation people do not begin to take shelter until the warning of imminent attack. Under these circumstances panic might well occur around the entrances to shelters. If there are to be many more people trying to get into a given shelter in a given time than is the case when people start shelter taking during the yellow warning there will be a greater likelihood of blockage under these conditions. This, plus the existence of the other prerequisites to panic described in the body of the statement, make such behavior likely. However, if a substantial portion of the population has gotten well away from the target before the imminent attack warning, there may be no unbearable load in the shelter ingresses. The problem of the population pressures on a particular shelter a given number of minutes after evacuation is underway is a complex technical one but one which should yield to operations research methods.

If shelter taking begins for all the population during the yellow alert it is possible that most if not all people will be sheltered by the attack imminent warning though this, of course, depends on the length of warning time and the proximity and ingress capacity of the shelters. If the attack imminent warning comes when more people are outside than can get inside in the time perceived as left, there may be panic. Panic would seem to be more likely in the case of shelter taking than on the highways in the last minutes before the attack. This, because taking shelter is more likely to be perceived as lifesaving (partially as a consequence of more effective training and indoctrination in their use) than anything one could do on the road in the time left. Hence there is more likelihood of a frantic struggle to get into the shelters than there would be to get farther out of town during these last minutes.

At any rate, panic or not, there is the question of who is to close the shelter doors and when. No rules and regulations will adequately resolve the emotional conflicts struggling within a doorkeeper. There will be pressures from within the shelter and himself to shut the doors before it is too late; there will be pressures from within the shelter, within himself, and from without to hold the doors open so that more people may enter and be saved. Furthermore, there will be no way to know when the last minute of grace will have arrived.

Now since the doors will have to be very large, if the ingresses are to be adequate in the first place, closing them will have to be by machine power. Also since only those shelters will survive which are not directly under the fireball there will be a few or many seconds between the explosion and the effects of heat, blast, and fallout (the shelter has to be radiation proof to begin with and zigzag ingresses will block line-of-sight initial radiation). During this time the doors could be closed by automatic, high speed, machine drives, closure being triggered upon stimulus from the light of the fireball through a photoelectric detector-actuator system. This would remove the door-closing problem from the area of human judgment and also assure both those in the shelter and those trying to get in that the interests of both would be served to the utmost.

4. THE POSTATTACK PERIOD

Communication control and rumor control will be easier in the case of shelter-contained populations than for evacuation refugees. Because the area and group are restricted and predefined it will be easier to convey information and emotional support to them and it will be easier to detect rumors. Since rumors in a given shelter will have to be confined to that shelter (as long as fallout, etc., prohibits mobility) it will be much easier to design and direct counterrumor communications. It may well be more difficult to start rumors in a shelter than in a support area encampment because people will tend to recognize the universal limitations on access to exclusive information (upon which to base a rumor) to which members of a shelter will be subject by reason of confinement to the shelter. It will be difficult for a person to claim convincingly that they heard something about something from someone who had just come from somewhere—or some such—simply because there will be no one from outside during the early period. Though as the shelters open up, and if they are used as living space subsequently, this inherent protection from rumors will disappear.

There is a facet to rumor control in the shelters which will need special attention: since the communication personnel will be the chief (and for a while the only source) of outside information they must be carefully trained not to pass on informational tidbits unofficially to friends or other persons. They must also be trained to be alert for rumors which specify them as the source of the rumor content and they must be prepared to counter any such assertions publicly and quickly. Such ascription of source can and will occur under other than shelter conditions but because of the likelihood that those in the shelter will recognize the communicator as the unique source of information there may well be a special problem in rumor "decontamination" and control here.

A greater proportion of people are likely to be in the shelter which they selected in the preattack period than are likely to be in any preselected area along evacuation routes because there are more contingencies mitigating against the probability of being in a given place along evacuation routes. Hence, if sufficient intershelter communications and adequate procedures are set up it should be possible to symbolically reunite a greater percentage of families faster than would be the case if evacuation were the survival procedure utilized. Hence, depression, anxiety, and the intense need to search physically for family members will be less under shelter circumstances with a consequent increase in the recovery rate for morale and reorganization.

If shelters have been defined as and demonstrated to be capable of filtering out radioactivity and bacteria there will be less recourse to pseudo sickness simply because the potentiality of a real basis for arguing the significance of symptoms will not exist. However, a demonstration of no radiation or bacteria, in fact, will not by any means eliminate pseudo sickness since the state of mind associated with this behavior does not necessarily require a potential basis in fact. It should, however, reduce its prevalance below that existing among evacuation refugees.

Finally, if the shelters do a reasonable job of saving lives there should be far less hostility directed toward the authorities than is likely to be the case if evacuation is the dominant mode of survival effort. Shelters will be perceived as a positive effort on the part of the authorities to protect the public whereas evacuation is likely to be perceived as emphasizing that the individual is responsible for protecting himself and his family. Unless evacuation is far more successful than we have any reason to believe it will be, people will be likely to blame the authorities for not helping them far more than they will blame them if some shelters are destroyed. The consequences for morale are obvious.

Mr. HOLIFIELD. We have to go; this is a quorum call.

This is our last formal hearing of the series of 5 months of hearing. We will leave the record open for additional statements and letters which we have solicited and also for the filing of statements by Members of Congress for the record.

(The letters referred to are contained in exhibit 1 of the appendix.)

equipment which would be extremely valuable. If our retaliation is successful, I see no reason for the Army to embark on an overseas conventional war; if it is not successful, we are licked anyway.

V. What is wrong with the present civil-defense system?

A. It is fragmented. It has no control over dispersal and road-building which are its most important elements. It has no control over the use of Army and Navy personnel in event of attack.

B. At present civil defense is treated as a local problem. It is no more local than air defense, but certainly no one would propose that each city should maintain its own interceptor force.

C. There is no active interest in civil defense in any part of the country nor at any level of the Government. Ten years of inadequate effort have convinced the people that nothing can be done.

VI. What is needed?

A strong group with money, authority, and guts to do the things which so obviously need doing, even though some of them may not be popular. Dispersal must be achieved by building a fast transportation system so people can live farther apart. Tax reductions would achieve industrial dispersion without detailed Government direction.

Evacuation routes should be planned and bottlenecks removed.

A warning system capable of awakening and informing the people should be provided.

Cover from fallout should be constructed.

The military forces should be trained for their role in event of attack.

The facts of the situation should be told to the people.

VII. How can this be achieved?

LAW SCHOOL OF HARVARD UNIVERSITY,
Cambridge 38, Mass., February 2, 1956.

Hon. CHET HOLIFIELD,
Chairman, Subcommittee on Military Operations,
Committee on Government Operations,
House of Representatives, Washington, D. C.

DEAR REPRESENTATIVE HOLIFIELD: I am writing belatedly in response to your letter of December 19. Shortly after I received it, I was required to make two extended trips that threw all my other activities badly in arrears. However, I have been less concerned on the score of this delay because I have known that any statement of my own views would have largely repeated the opinions expressed in a letter to you by Mr. Gerhard D. Bleicken, secretary of the John Hancock Mutual Life Insurance Co. Mr. Bleicken and I have worked closely together in studying the problems of atomic defense, and I am glad to associate myself with the views he has already communicated to you.

I believe it might be helpful, however, if I were to supplement Mr. Bleicken's letter by developing a few points that seem to me to merit emphasis. Before I do so, however, I should like to identify myself and explain the origin of my concern with the problem the Subcommittee on Military Operations is considering.

I have been a member of the faculty of the Harvard Law School since 1945 and hold the Fessenden professorship of law. I have been associate dean of the school since 1951. I am a member of the New York State bar and of the bar of the Supreme Court of the United States. From 1933 to 1945, I was a member of the faculty of the Duke University School of Law. During World War II, I was granted a leave from Duke and served as assistant general counsel for price and later as associate general counsel for price in the Office of Price Administration.

In the fall of 1950, members of the Harvard Law School faculty were invited by the dean to submit suggestions for studies that might be helpful if the all-out war that then seemed imminent were to occur. I proposed a study of the legal measures that might be taken to minimize the effects of atomic attack on this country. The threat of war subsided, and the study was not initiated. However, in furtherance of my proposal, I made inquiries as to the precautionary measures that the Government had actually planned. At first, I could scarcely believe the negative information I received. It took me some time to accept the fact that a Government that was spending tens of billions each year for military purposes had taken virtually no steps to assure the continued effective functioning of the country if atomic war should come.

Since that time, I have tried to keep informed as to nonmilitary defense developments. I have urged the view that Government, the bar, and business should join forces in framing suitable standby measures that could be invoked at once in case of atomic war. Pursuing this objective, I have taken part in the work of the National Planning Association's Special Committee on Nonmilitary Defense and have recently been serving on the committee on civil defense of the National Research Council. I have lectured 3 times at the Industrial College of the Armed Forces, and my first 2 lectures have been distributed for use in its correspondence courses. I have been appointed to the newly created committee on the impact of atomic attack on legal and administrative processes of the American Bar Association. Several articles and talks of mine on the problem have been published; a list of these and my ICAF lectures is appended to this letter.

In accord with Mr. Bleicken, I believe that the present need is for a Presidential or congressional commission which would undertake a full-scale study designed to identify the multiple, interrelated problems of nonmilitary defense and to determine the form of governmental organization needed for an effective attack on the planning and operational problems that have been identified.

I do not believe these problems are within the reach of a standing committee of the Congress. They cut across too many fields. They call for a specially constituted staff. Even the problems of governmental organization cannot well be isolated for special study by a congressional committee. Until a better picture is drawn of the operational problems that would be faced by the Federal, State, and local governments and by our economy in the case of an attack, it will be exceedingly hard to devise a suitable governmental organization and equip it with appropriate powers. The problems the Nation would be up against would be unique, and we now appear to have only the vaguest notions of how they are to be handled. Hard, imaginative analyses of the situations that could be anticipated would enable us to plan with some degree of assurance. Improvisation without such study could be very costly.

If an adequately staffed commission were to devote a year to finding out what our organizational and operational problems really are before formulating any legislation to meet them, that would not be a year lost. Much of the same work would have to be done and would require about the same time even if the Congress were to create a new department for civil defense tomorrow.

With respect to the general nature of the problem that the subcommittee is considering, I should like to stress three points.

1. *The first and basic problem of nonmilitary defense is to enable this country to win the war.*—We could lose an atomic war through inability to keep the country functioning and willing and able to fight. If our enemy should use nuclear weapons against our cities on a large scale, this would not be done to destroy productive capacity or to kill actual or potential soldiers. An atomic war would be too rapid and too destructive to turn on the relative ability of the antagonists to outproduce each other to raise great armies. The purpose of the atomic attacks would be to disrupt our government, our economy, and our society to such an extent that we simply could not and would not continue fighting as a Nation. Our objective would be the same. The side would win which first brought about the political, economic, and social disintegration of the other nation.

If that is the prime purpose of the kind of warfare we expect in case war comes, then how can the Government, especially the military departments and forces, continue to disregard the problem of organizing the Nation to meet it? In stressing the responsibility of the military departments and forces, I do not mean to imply that I regard the job as one that they should do. They are entitled to demand that the job be done.

2. *The Nation's success in functioning in the crisis during and after a series of atomic attacks would depend not on the communities that are actually bombed or are denied by fallout but on the unbombed, uncontaminated areas.*—The latter must take the brunt of keeping the wheels turning, administering and operating the network of emergency controls and services that would enable the country to keep going. For them to discharge these duties effectively and to provide for, and organize, the hordes of survivors of bombed areas and the evacuees from as yet unbombed target areas calls for preparatory plans and organization. Even so, the task would tax the human resources of the untouched communities to the utmost.

Despite these facts, virtually all the efforts of civil defense to date have been focused on the target areas. The problem has been seen in terms of a gigantic local first-aid problem. With few exceptions, the communities on which the Nation would really have to depend to keep running have been allowed to remain unconcerned and indifferent. They are not to blame for this, but their present ignorance of their responsibilities underscores the toughness of the planning and organizational problems that lie ahead.

3. *As long as we are in danger of atomic war and risk defeat in such a war, our immediate need is to plan to operate with the resources we have and to work with the Nation's physical plant as it is.*—We should organize to meet the short-range hazard without waiting until we can

perfect needed long-range plans for the dispersion of industry and for the creation of satellite cities.

One comforting consideration is that the total cost of developing the essential plans and the standby operations to carry them out, with such basic equipment and facilities as would be needed, would be tiny in comparison with our military budget. Certainly a great deal could be accomplished in nonmilitary defense planning and organization with no more than 1 percent of the military budget. The crux of the problem is to learn how in a crisis we could use effectively what we already have (including people who have peacetime jobs). To do this doesn't require huge staffs or huge procurement programs.

One exception might be made to the relatively inexpensive character of the immediate program that seems to me essential at this time. We could minimize the risk of mass starvation of evacuated populations by a system of storehouses of surplus agricultural commodities, processed to a point where they could be utilized in case of need without further processing, and located in the areas to which the evacuees would tend to concentrate. The stocks could be revolved so as to remain in usable condition. Such a program would turn a national liability into an asset and its cost should not be prohibitive.

With the permission of the commandant of the Industrial College of the Armed Forces, I am enclosing a copy of a lecture I delivered at the college on October 25, 1955, on the subject of "Economic Stabilization After [Atomic] Attack."

Sincerely yours,

DAVID F. CAVERS.

LAW SCHOOL OF HARVARD UNIVERSITY,
Cambridge 38, Mass., January 12, 1956.

Representative CHET HOLIFIELD,
Chairman, Military Operations Subcommittee,
Committee on Government Operations,
House Office Building, Washington, D. C.

DEAR MR. HOLIFIELD: I recall your letter of December 20 and my reply of December 28 in the matter of the study of civil defense that your Military Operations Subcommittee is undertaking.

It occurred to me that it might be useful to try my hand at drafting such amendments as would, in my judgment, bring the Federal Civil Defense Act into line with current needs. The result is the suggested amendments set out in the mimeographed paper I enclose. I hope this may be useful in the work of your subcommittee.

Sincerely yours,

CHARLES FAIRMAN.

SUGGESTED AMENDMENTS TO FEDERAL CIVIL DEFENSE ACT OF JANUARY 12, 1951, PUBLIC LAW 920, 81ST CONGRESS; 64 STAT. 1245; 50 U. S. C. APP., §§ 2251–2297

By Charles Fairman, Harvard Law School

DECLARATION OF POLICY

New § 2 [50 U. S. C. App., § 2251]. It is the intent of Congress by this legislation further to provide for the common defense of the people of the United States against the danger of modern weapons by establishing a more effective system of civil defense. In the light of experience it is now found that responsibility for civil defense must rest primarily with the Federal Government: (1) The defense of the Nation against foreign attack is at all times primarily a duty of the United States; (2) it is for the Federal Government to judge of the danger of attack, to give timely warning, and to initiate countermeasures; (3) national leadership would be absolutely necessary in carrying on after an attack, and hence is required in planning measures, in establishing standards and in conducting practical tests; (4) civil defense must cope with metropolitan areas that intersect State lines, and must arrange mobile support across State lines; (5) common practices must be developed throughout the United States in order to facilitate effective operations; (6) civil defense involves dealings with friendly foreign governments, notably those of neighboring countries; (7) the fiscal and other powers of the United States must be exerted in order to give adequate protection to all the people of the United States.

It is further found, however, that the States and their subdivisions must have an important part in the national system of civil defense and must bear a corresponding responsibility for the effective performance of that part: (1) The preservation in full vigor of the civil institutions of the several States, at all times, is itself one of the great purposes to be subserved; (2) the national system of civil defense should rely upon State or local action wherever such action would be of superior fitness or propriety; (3) many of the concerns of civil defense involve merely the normal functions of State and local government as carried on at a time of national distress; (4) some of the concerns of civil defense involve the safeguarding against enemy action of vital records kept under State or local authority, and the inducing of State or local action on matters essential to national survival; (5) civil defense must in large part be carried out through the agency of the governmental machinery, staff and facilities of the several States and their subdivisions.

AMENDMENTS TO SECTION 201 (50 U. S. C. APP., SEC. 2281)

Insert, between present (e) and (f), a new subsection:

( ) Develop, with the aid of State and local subsection: or other competent persons, model legislation and model administrative regulations and procedures on matters of concern in civil defense.

Insert, between present (g) and (h), a new subsection:

( ) Assist and encourage the States to establish in each metropolitan defense area, as defined by the Administrator, a unified civil-defense organization; and in the event such organization is not established and maintained in effectiveness by the State or States concerned, the Administrator is authorized to establish and maintain such organization, and to proceed to develop plans, recruit personnel, provide facilities, make arrangements with governmental units, and conduct test exercises and require public participation therein as may be needed.

Insert, between present (h) and (i), a new subsection:

( ) In respect of civil-defense activities to which the Federal Government makes financial contribution, prescribe standards, including, but not limited to size of staff, qualifications, and salary scales; prescribe objectives in civil-defense planning and organization, with target dates therefor; and inspect for compliance with such standards and for the practical effectiveness of the planning and organization.

AMENDMENTS TO SECTION 303 (50 U. S. C. APP., SEC. 2293)

Insert, between present (c) and (d), a new subsection:

( ) Direct and supervise civil-defense operations of the States and their subdivisions, including the evacuation of the inhabitants of designated areas and their reception and care in other areas, as may be needed for the common defense of the people of the United States: *Provided*, That by direction of the President, such training evercises may be conducted at any time regardless of whether a period of emergency has been declared, as may be needed to test the adequacy of preparations and to insure effective operation in time of emergency. On such occasions all officers of the States and of their subdivisions shall comply with such directions as shall be given by the President or by competent authority on his behalf.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
SCHOOL OF ARCHITECTURE AND PLANNING,
Cambridge 39, Mass., January 6, 1956.

Hon. CHET HOLIFIELD,
Chairman, Military Operations Subcommittee of the Committee on Government Operations,
House Office Building, Washington, D. C.

DEAR MR. HOLIFIELD: Thank you for the opportunity to comment on your letter of December 20, 1955, and the bills attached to it. Effective civil defense is not, as you know, an easy subject.

First, it must be clear to any student of modern warfare that one cannot counter the spectacular advances in weapons technology by countermeasures at the civil level, and that even if specific countermeasures were found, the time scale for effectuation of civil defense measures is vastly longer than that of weapons of attack. Hence the civil defense effort must aim at a general improvement in the situation to be faced if all-out war should come, balancing and rebalancing a wide range of measures to reduce urban vulnerability, to roll with the attack, and to recover afterward—under every conceivable combination of attacking weapons. Instead of seeking absolute protection against any single form of attack, the planners must turn rather to calm and imaginative probability analysis.

Second, the execution of civil defense plans must be guided by a strong sense of economy. By this I mean not only the search for optimum yield for the outlay but also the basing of measures upon a thorough understanding of the structure and growth of our urban economy. A policy that seems to cost nothing may upon analysis have a very expensive effect upon national development, and conversely one that sounds at first very costly may be carried out substantially for nothing in the natural course of that development.

Third, simultaneous consideration must be given to several different time scales. Within the next two decades we shall create an entirely new physical structure for half of our urban population and extensively remodel the other half, and measures taken to strengthen and improve this physical structure for optimum peacetime operations are likely to be the very ones needed for civil defense. These measures may prove on analysis much more important than short-range stopgap measures that loom larger in public attention.

In short, civil defense must be deeper in concept, broader in base, and longer in time scale than at present. Yet the total economic effort attributed to it need be no larger.

The first step must be to concentrate the responsibility and authority for civil defense, instead of scattering it among FCDA, ODM, Commerce, Defense, Housing, and elsewhere. The second step must be to broaden this responsibility until it includes the major aspects of governmental concern for sound urban development, because civil defense is but a special case of this general concern.

An agency entrusted with such a responsibility would have a positive and continuing function in peacetime, and might reasonably be expected to take over extremely complex and responsible roles in wartime. For the current FCDA to shift over from planning to operating in the midst of attack is unrealistic, especially since it may be assumed that there will be no time for developing experience under fire.

Furthermore an ad hoc civil defense agency like FCDA has before the Congress and the public the single possible peacetime role of a prophet of doom. The head of any such agency, as he attempts to explain the threat and to urge preparations to meet it, is almost sure to find his most serious pleading discounted as empire building and his direst warnings gradually disregarded as they become familiar to an apathetic public.

I should like to see civil defense become a part of the general responsibility of an urban development agency, with an effective bridge to a defense agency in which the orientation was increasingly shifted away from the traditional military to the entire scientific, technological, and economic problem of future warfare between civilizations. In my opinion, it would be a serious mistake to place the civil defense function in a defense agency, although constant reliance would have to be placed on such an agency for help in planning and in wartime operations.

The overall agency, in which civil defense was only a part, should have as a major normal operating concern the encouragement of sound urban growth. Ideally, this might be a department of Cabinet rank, to balance that of Agriculture and reflect the fact that by the year 2000 we shall be a 90 percent urban Nation. At the moment an agency in the Executive Offices of the President may prove more practicable. In either case, it should have not only the present civil defense functions of FCDA, ODM, Commerce, and HHFA, but also the entire housing and urban renewal functions of HHFA, the urban aspects of the public roads program, the statistical reporting of Labor, and as many comparable pieces of the urban development responsibility of the Federal

Government as could logically be transferred, with directives that made clear the requirements of depth of concept, breadth of base, and length of time scale. At the head should be a man who would represent to the Nation the importance of guiding its future urban growth along sound lines—a positive and lively role in which civil defense would be but one important, interwoven part.

Very truly yours,

BURNHAM KELLY.

UNIVERSITY OF MICHIGAN,
Ann Arbor, January 6, 1956.

Hon. CHET HOLIFIELD,
Chairman, Military Operations Subcommittee,
Committee on Government Operations,
Congress of the United States,
House Office Building, Washington, D. C.

DEAR SIR: Thank you for your letter of December 19 in which you invited me to give my views on the civil defense problem.

Unfortunately the press of other duties has prevented my attending more than one meeting of the Civil Defense Advisory Committee of the National Academy of Sciences, and my principal contact has been the consideration of the technical aspects of warning devices. The conclusion to which our subcommittee came was that warning devices were perfectly feasible either through special radios or through power company or telephone lines. The difficulties appear not to be technical but rather financial and, to some extent, considerations of convenience or inconvenience to the utility companies. As you say, the problems of civil defense are many and complex and I only wish that I had something more definite in the way of advice and help that I could give you.

Sincerely yours,

DAVID M. DENNISON,
Chairman, Department of Physics.

UNIVERSITY OF MINNESOTA,
THE MEDICAL SCHOOL,
Minneapolis 14, January 30, 1956.

Hon. CHET HOLIFIELD,
Chairman, Military Operations Subcommittee,
Committee on Government Operations,
House of Representatives,
House Office Building, Washington, D. C.

DEAR REPRESENTATIVE HOLIFIELD: Thank you for your recent letter in which you give me an opportunity to express my views on the national civil defense effort today.

As you point out, I have given some thought to problems of civil defense as a member of the Civil Defense Advisory Committee of the National Academy of Sciences. As a professional public health worker, as a member of the faculty of the University of Minnesota School of Public Health, and a member and vice president of the

Minnesota State Board of Health my attention has also been focussed on some of the problems associated with civil defense. I am sure, however, you will understand that I am not authorized to speak for the Civil Defense Advisory Committee of the National Academy of Sciences, the University of Minnesota, or the Minnesota State Board of Health. This letter is written to you as a private citizen.

In my opinion the greatest single defect in our present civil defense effort is its comparatively insignificant status at the Federal level. Properly the States and municipalities must play a part in civil defense planning and operations. However, I believe it is completely unrealistic to expect these smaller units of Government to carry the major portion of the civil defense responsibility. In the event of another war the most important asset we will have will be people, and it is highly important that the protection of these people be a part of our overall national defense scheme. Considerably less than 1 percent of our national defense budget now goes to civil defense. I do not mean to imply that appropriations to the Armed Forces are too large. I feel that the appropriations for civil defense are far too low.

The first step in improving our civil defense must be the elevation of the status of the civil defense office at the national level. In my opinion both the proposals in House Concurrent Resolution 108 and House Joint Resolution 98, in attempting to do this, have real merit. Of the two proposals which have been made, namely the creation of a new department of civil defense or the creation of a department of civil defense (which will be of equal rank with the existing military departments) in the Department of Defense, the latter is, in my opinion, preferable. I feel if it is created this new department should have representation on the Joint Chiefs of Staff. It would seem to me that evaluations of civil potentials as well as military potentials must be made in any decision reached by the Joint Chiefs of Staff. The creation of a new department within the Department of Defense would have the advantage of allowing for a free use during civil defense emergencies of reserve personnel of the Armed Forces who are on inactive-duty status.

Coupled with the need for increased status is the need for much greater appropriations. Larger appropriations are necessary not only for the purpose of setting up operational plans, but for stockpiling of vital materials but also for financing research. Already too much time has been lost in the field of essential research. Such research is necessary not only in the development of protective measures for the civilian population but also for obtaining knowledge in the field of human behavior under conditions of great stress. I am optimistic enough to believe that a civil defense office adequately financed and with adequate status could conduct the necessary planning and the essential research which will make it possible for our civilian population to function in time of war. Without such an adequately financed program there is grave danger that the next war, if it comes, might be lost because of the inability of our civilian population to support the war effort.

Sincerely yours,

HERBERT M. BOSCH,
Professor, Public Health Engineering.